

Appendix 3 Existing Conditions  
Memorandum (including  
Unincorporated Deschutes  
County, La Pine, Redmond,  
and Sisters)

## MEMORANDUM

**Date:** April 4, 2019  
**To:** Chris Doty, Deschutes County  
Chris Cheng, Oregon Department of Transportation

Project #: 21829

**From:** Alicia Hunter, Mike Alston, Ashleigh Ludwig, PE, and Brian Ray, PE

**Project:** Deschutes County Transportation Safety Action Plan (TSAP)

**Subject:** Existing Conditions Summary

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## MEMORANDUM OVERVIEW

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Kittelison & Associates, Inc. (Kittelison) is developing the Deschutes County Transportation Safety Action Plan (TSAP). This memorandum summarizes existing crash data and patterns for the Deschutes County TSAP. The evaluation findings will be used to identify emphasis areas for Deschutes County and inform the next step of the TSAP development, network screening. The Framework Memorandum, included as Attachment A, provides an overview of the entire TSAP development process for more background on the project. The Framework Memorandum also provides the County's vision and goals for this safety study and action plan.

## 01 | STUDY AREA

This section provides an overview of the study area for the Deschutes County TSAP and discusses how coordination will occur with the Bend Area TSAP, being conducted in parallel to this project.

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### DESCHUTES COUNTY TSAP

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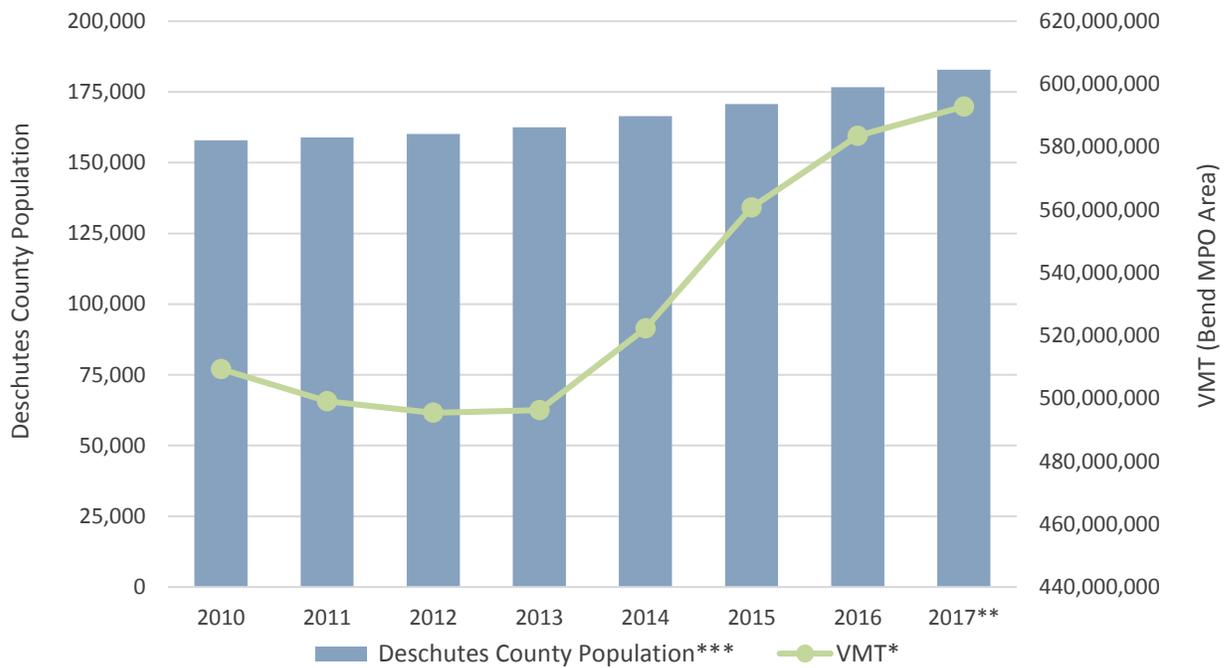
The study area for the Deschutes County TSAP includes the area outside the Bend Urban Growth Boundary (UGB), as discussed in the Deschutes County TSAP Framework memo (Attachment A). The cities of Redmond, Sisters, and La Pine are included in the study area and discussed separately within the analysis to identify emphasis areas unique to each city.

The annual Deschutes County population estimates are presented in Figure 1, alongside the annual estimate for vehicle miles traveled (VMT) for the Bend Metropolitan Planning Organization (MPO) area. From 2010 to 2017, the Deschutes County population grew by 16 percent, or 2.3 percent per year. VMT has grown by similar percentages over the same time period. Exposure, or number of miles traveled, is directly related to crash frequency. Higher VMT increases the risk for vehicles to be involved in a crash.

Figure 2 illustrates the annual numbers of crashes in the County. As shown in the figure, the number of reported crashes and the number of fatal/incapacitating crashes has been on an increasing trend in recent years. This pattern, along with the County's goal of eliminating fatal and severe crashes by 2035, emphasizes the need for developing a Transportation Safety Action Plan.

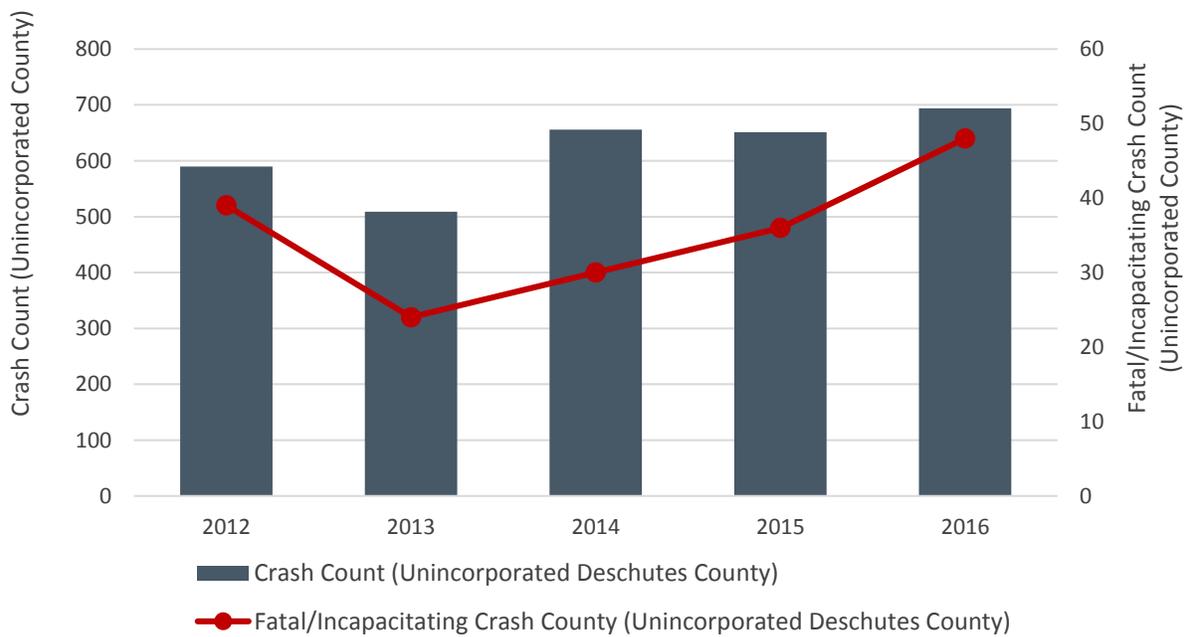
Figure 3 illustrates the project study area, the area outside the Bend UGB. The area outside the Bend UGB boundary but within the Bend MPO boundary is a special case. For this subset of roadways, safety recommendations will be included in both the Bend Area TSAP and the Deschutes County TSAP.

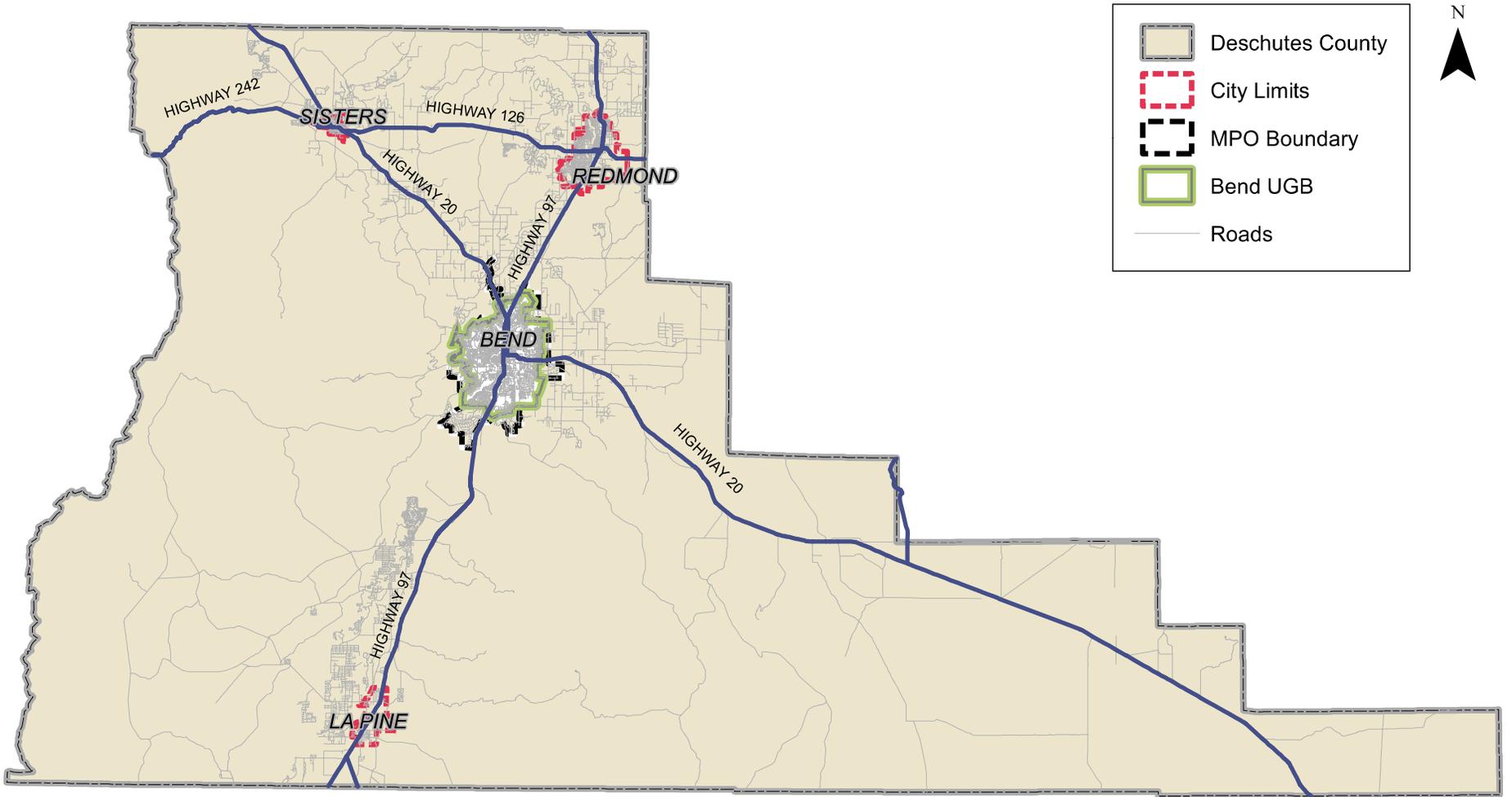
**Figure 1: Deschutes County Population and Bend MPO VMT by Year**



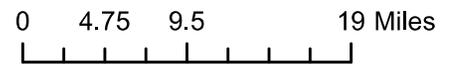
\*VMT estimates are provided for the MPO Area.  
 \*\*2017 VMT estimate is preliminary.  
 \*\*\*2010 Population estimates provided by the US Census; others by PSU annual estimates.

**Figure 2: Unincorporated Deschutes County Reported Crash Frequency**





- Deschutes County
- City Limits
- MPO Boundary
- Bend UGB
- Roads



**Study Area**  
**Deschutes County**  
**Boundaries**

Figure  
**3**

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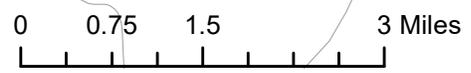
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## BEND AREA TSAP

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The City of Bend is completing a TSAP for the area within the Bend UGB. Kittelson is developing the Bend Area TSAP in parallel with the Deschutes County TSAP. Figure 4 illustrates the study area for the Bend TSAP. The two projects will be coordinated, with the analysis being conducted in parallel throughout the project. The Framework Memorandum (Attachment A) summarizes the steps of the analysis that will be completed jointly for both projects and how the recommendations will be split into both Plans. Many residents commute between communities within the County; therefore, coordination between agencies is required for the sake of consistency and continuity between each of the TSAP's recommendations.

City Limits  
 MPO Boundary  
 Bend UGB  
 Roads



**Study Area  
City of Bend  
Boundaries**

**Figure  
4**

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## 02 | DATA OVERVIEW

Kittelton obtained roadway, traffic, and crash data from the Oregon Department of Transportation (ODOT), Deschutes County, and the Bend MPO. Crash data for Deschutes County was obtained from ODOT's database for January 1, 2012 through December 31, 2016 and includes all reported crashes. Reported crashes include those resulting in an injury or fatality, as well as those resulting in over \$1,500 of property damage.<sup>1</sup> ODOT's crash database provides reported crash characteristics such as date, time, crash type, light conditions, roadway conditions, etc. that Kittelson used to analyze and document factors associated with crashes.

Complete and official crash data reports are released 12 to 16 months after the end of the year reported. Development of crash data reports is a partially manual process where each crash is evaluated individually to ensure the information is consistent with the crash site and the most accurately portrays the factors for crash coding. Each crash data report is then reviewed by technicians and undergoes a comprehensive quality assurance process.<sup>2</sup>

Crash severity, as reported in Oregon, is categorized into five categories: fatal, incapacitating (Injury A), non-incapacitating (Injury B), possible injury (Injury C - complaint of pain), and no injury (PDO - property damage only). A crash's severity is defined by the most severe outcome among all parties involved; the fatal and incapacitating crashes are considered the most severe and the focus of the TSAP. Crash data used in this memorandum discusses the number of crashes, not the number of injuries or fatalities. One crash may have resulted in multiple injuries or fatalities.

Combining crash data with roadway and traffic data can help analysts identify safety needs and identify appropriate countermeasures. Deschutes County and the Bend MPO provided roadway and traffic information in GIS format, including roadway functional classification, pedestrian and bicycle facilities, intersection traffic control, posted speed limits, traffic volumes, and bicycle level of traffic stress. Where possible, Kittelson joined the GIS information to the crash data to allow further exploration of characteristics associated with crashes. Table 1 summarizes the data requested and received from the County, MPO, and ODOT for this project.

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<sup>1</sup> ODOT increased the property damage threshold for reporting crashes from \$1,500 to \$2,500 as of January 1 2018. However, the data reflected in this analysis corresponds to a reporting threshold of \$1,500 of damage. (Source: <https://content.govdelivery.com/accounts/ORDOT/bulletins/1cbed84>)

<sup>2</sup> ODOT Crash Data Disclaimer: ODOT cannot guarantee that all detail pertaining to a single crash are accurate and as a result of data sharing ODOT disclaims liability of re-released crash data.

**Table 1: Data and Sources**

Data	Source
<b>Primary Data</b>	
Roadway Functional Classification	County
Traffic Volumes	County and MPO (Countywide and MPO datasets will be merged)
Reported Crash Data	ODOT - Countywide dataset will be used
Jurisdiction	County and MPO
Traffic Control	County and MPO
<b>Secondary Data</b>	
Posted Speed Limit	County and MPO (Limited coverage available.)
Lane Widths	MPO
Sidewalk Presence	MPO
Bicycle Facilities	MPO
Trails	MPO
Bicycle and Pedestrian Volumes	Not Yet Provided, may be available for select areas within MPO
Transit Routes and Stops	MPO

## 03 | CRASH DATA ANALYSIS

Kittelsohn analyzed crash data for Deschutes County to identify crash characteristics, roadway characteristics, or behavioral characteristics associated with fatal and incapacitating crashes.

The analysis in this section is organized into four parts, based on locations as follows:

- ▶ Unincorporated County;
- ▶ City of La Pine;
- ▶ City of Redmond; and
- ▶ City of Sisters.

Each location is presented separately to identify crash patterns unique to each area. For additional analysis of the unincorporated county, Kittelsohn compares crash patterns between state and county facilities. County facilities include forest service, county, and other county roadways. Throughout the remainder of the TSAP all county facilities are categorized and referred to as county facilities. Roadways within unincorporated Deschutes County fall within a variety of jurisdictions. Deschutes County and the Oregon Department of Transportation (ODOT) have jurisdiction of the majority of roads within the County. State highways such as US 97, US 20, and OR 126 carry large volumes of traffic between cities. At intersections of county facilities and state facilities, crashes within the intersection influence area (250 feet from the center of the intersection) are assigned to the state highway.

Within each section, crash data is presented with respect to the following categories:

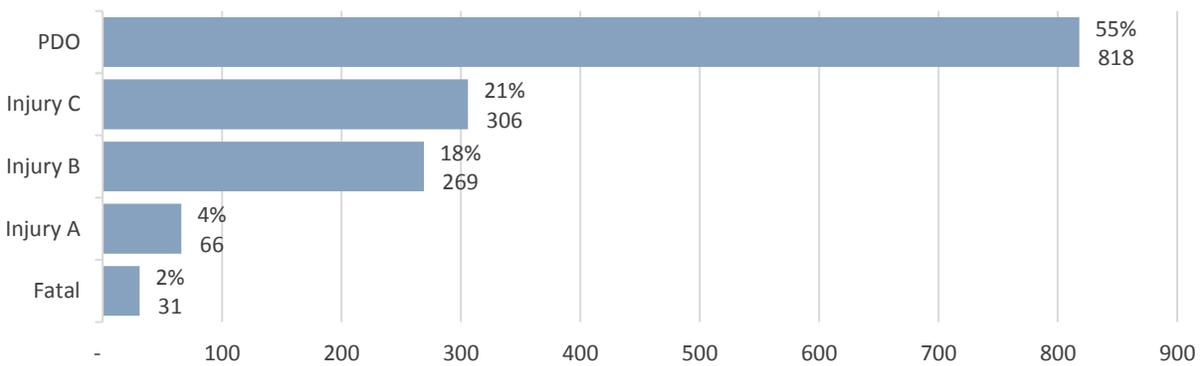
- ▶ Trends by Year, Month, Day, and Time;
- ▶ Roadway Characteristics;
- ▶ Crash Characteristics,
- ▶ Behavioral Patterns, and
- ▶ Vulnerable Road Users (pedestrians, bicyclists, elderly drivers, and motorcyclists).

## DESCHUTES COUNTY CRASH ANALYSIS

This section summarizes the crash analysis for the unincorporated area of Deschutes County. The crash data excludes crashes within the Bend UGB and the cities of La Pine, Redmond, and Sisters. A total of 3,009 crashes were reported in unincorporated Deschutes County between 2012 and 2016.<sup>3</sup> Of these crashes, approximately half (1,519 crashes) occurred on county roads, and half (1,490 crashes) occurred on state highways.

Crash severity is categorized into five categories: fatal, incapacitating (Injury A), non-incapacitating (Injury B), possible injury (Injury C - complaint of pain), and no injury (PDO - property damage only) based on the most severe outcome among all parties involved; the fatal and incapacitating crashes are considered the most severe and the focus of the TSAP. In the five years of data analyzed, Deschutes County had a six percent fatal and incapacitating crash share on state facilities and a five percent share on county facilities, as shown in Figure 5 and Figure 6. Nearly 50 percent of all crashes resulted in some level of injury for state and county facilities. Among the 174 fatal/incapacitating crashes in the unincorporated County, 97 crashes (56 percent) occurred on state highways.

**Figure 5: State Facility Crashes by Severity, Deschutes County (Unincorporated) 2012 – 2016**



**Figure 6: County Facility Crashes by Severity, Deschutes County (Unincorporated) 2012 – 2016**

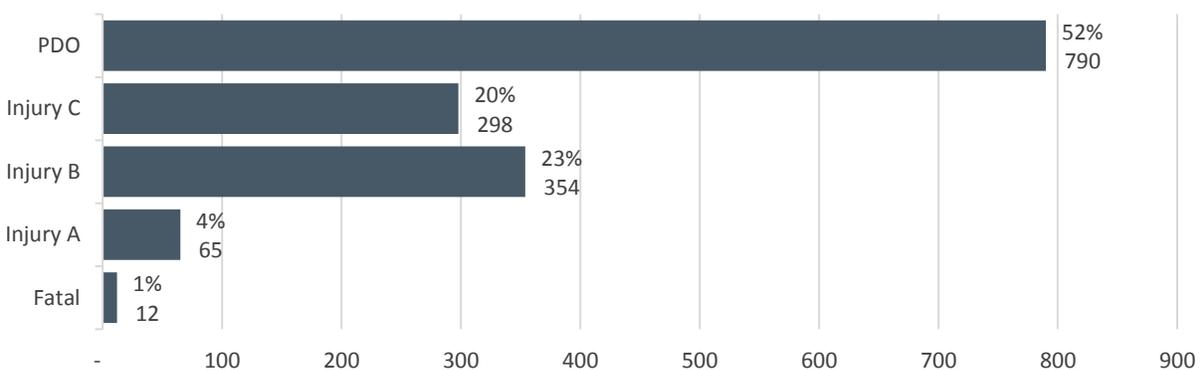
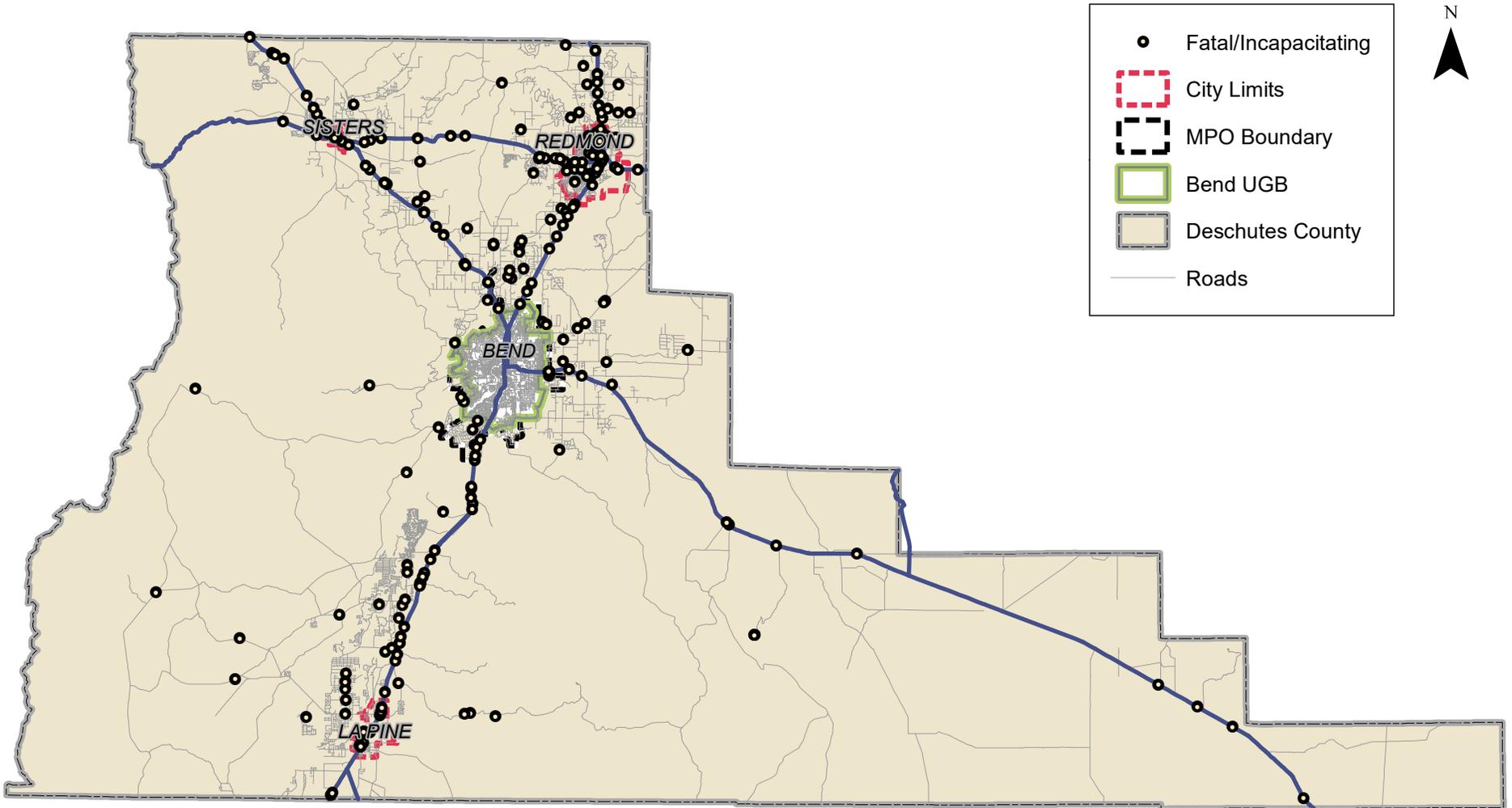


Figure 7 shows the locations of fatal and incapacitating crashes in the County. As show on the figure, fatal and incapacitating crashes occurred on roads throughout the County, with many occurring on state highways between cities.

<sup>3</sup> A total of 3,100 crashes were included in the crash database for the unincorporated County. However, upon closer examination of the crashes, 91 crashes (including one fatal and two incapacitating injury) were identified as "not locatable" by ODOT and therefore cannot be assigned roadway or jurisdiction characteristics. These crashes are excluded from the Countywide analysis.



**Fatal and Incapacitating Crashes  
Deschutes County  
Reported Crashes 2012 - 2016**

**Figure  
7**

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## ROADWAY CHARACTERISTICS

This section summarizes roadway characteristics such functional classification, intersection related crashes, light conditions, and roadway conditions associated with reported crashes.

### Functional Classification

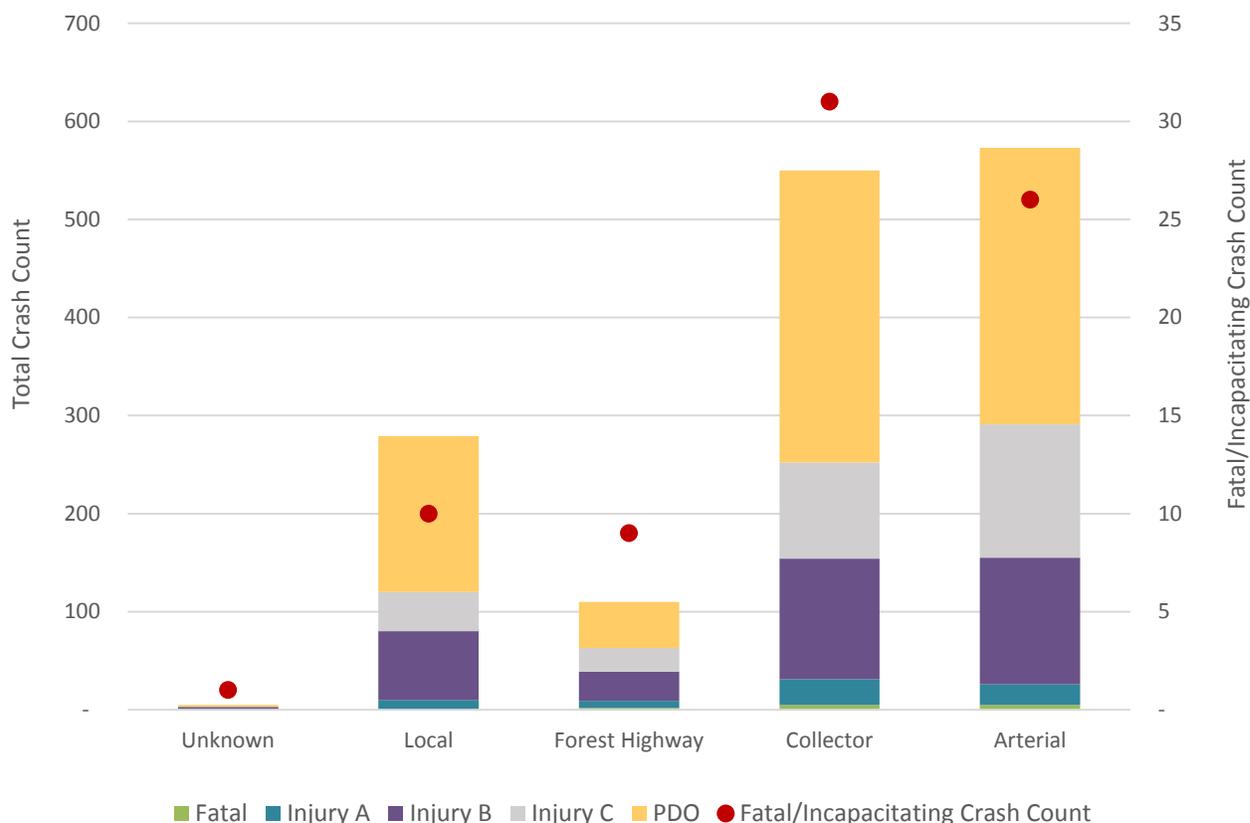
Roadway functional classification designations delineate differences in purpose and design, describing the primary function of the roadway. Arterials are intended to move traffic through an area, while local streets are primarily intended to provide access to destinations. Collectors provide connections between arterials and other roadways.

As previously discussed, Kittelson mapped crashes and spatially joined roadway attributes, including functional classification, to each crash. In the case of crashes occurring within an intersection influence area (250 feet from the center of the intersection), crashes were assigned to the higher order facility. This section focuses on county facilities.

As shown in Figure 8, 38 percent of reported crashes occurred on arterials and 36 percent occurred on collectors. Of fatal or incapacitating injury crashes, 40 percent occurred on collector roads, and 34 percent occurred on arterials. Crashes on forest highways accounted for seven percent of all reported crashes and 12 percent of fatal/incapacitating crashes. Of the crashes reported on each facility type, the following percentages resulted in fatality or incapacitating injury:

- ▶ Fourteen percent (one of seven crashes) of unknown crashes;
- ▶ Eight percent (nine of 110 crashes) of forest highway crashes;
- ▶ Six percent (31 of 550 crashes) of collector crashes;
- ▶ Five percent (26 of 573 crashes) of arterial crashes; and
- ▶ Four percent (10 of 279 crashes) of local road crashes.

**Figure 8: County Facility Crashes by Functional Classification, Deschutes County (Unincorporated), 2012 – 2016**



	Unknown	Local	Forest Highway	Collector	Arterial
Fatal	-	-	2	5	5
Injury A	1	10	7	26	21
Injury B	2	70	30	123	129
Injury C	-	40	24	98	136
PDO	2	159	47	298	282
Fatal/Incapacitating Total Count	1	10	9	31	26

## Intersections

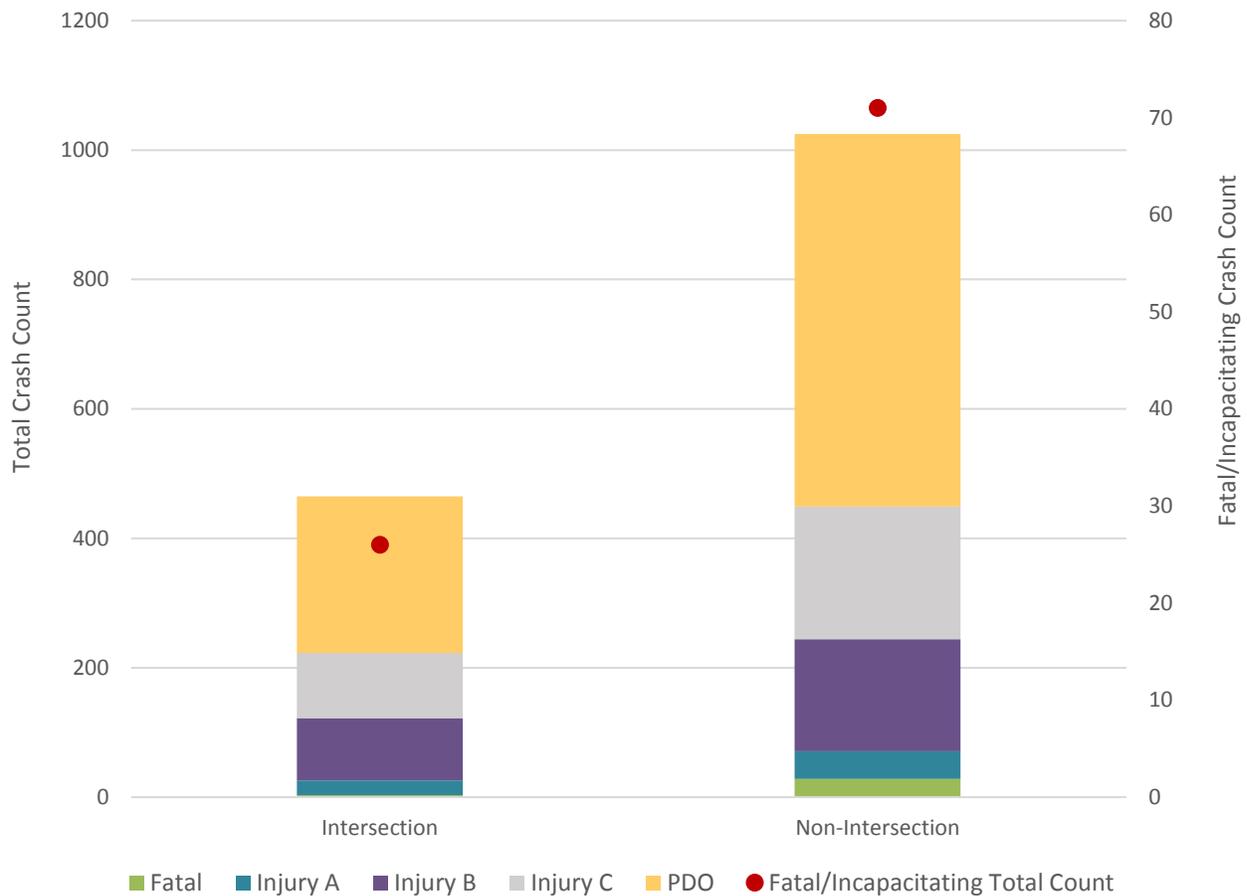
Kittelson classified crashes by their location relative to intersections: those within 250 feet of an intersection were classified as *intersection crashes*, and those further than 250 feet from an intersection were classified as *non-intersection crashes*. Intersections represent locations within the street network with the highest concentration of conflict points (i.e., vehicle paths crossing).

For the state facilities in unincorporated Deschutes County, 465 (45 percent) reported crashes occurred at intersections. Of the 97 fatal/incapacitating crashes on state facilities, 27 percent occurred within 250-feet of an intersection.

For county facilities, 788 (52 percent) reported crashes occurred at intersections. Of the 77 reported fatal/incapacitating crashes, 38 percent occurred within 250-feet of an intersection.

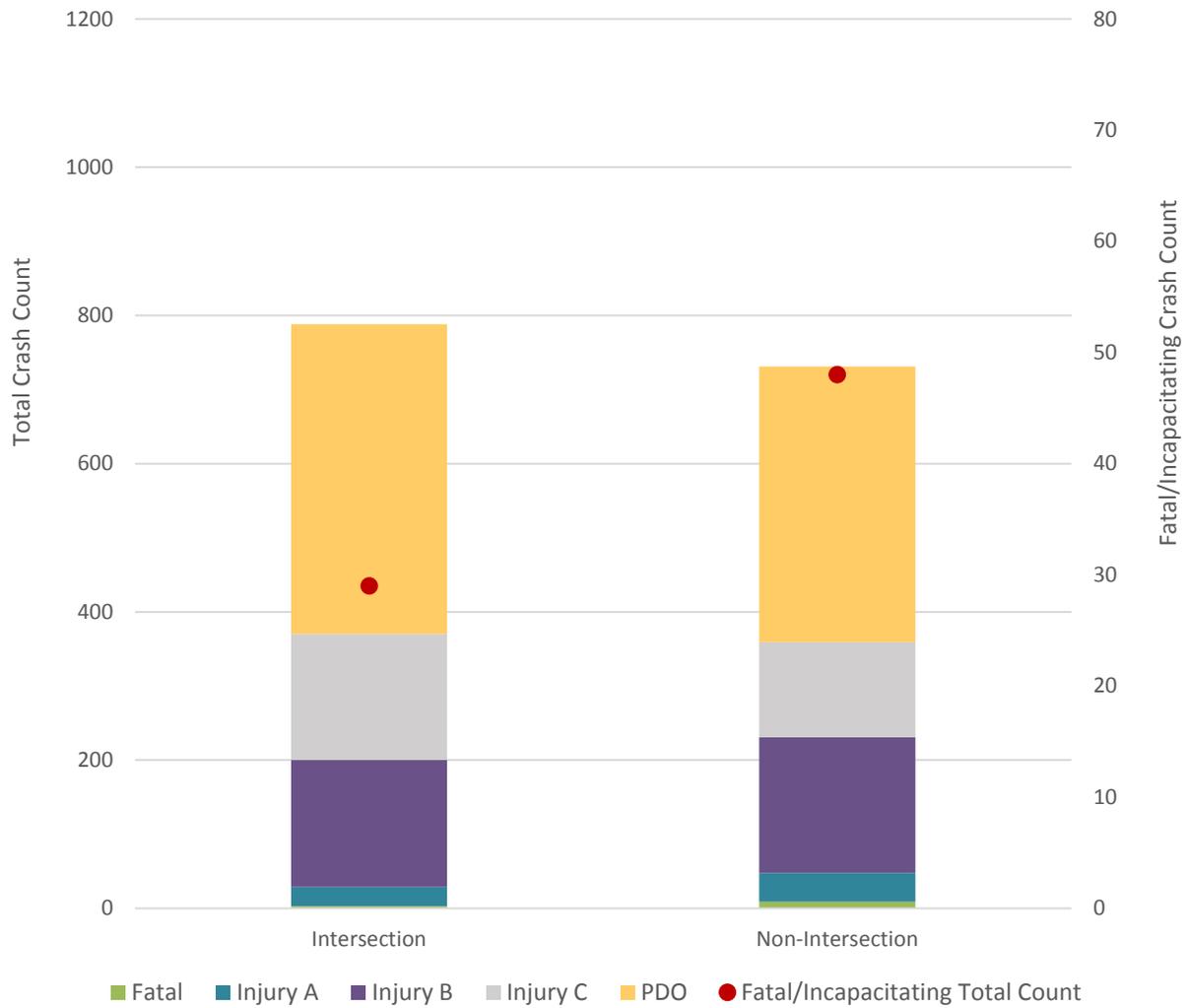
Of reported intersection crashes, two percent resulted in fatality or incapacitating injury for both state and county facilities. Non-intersection (segment) crashes were more likely to result in fatality or incapacitating injury compared to intersection crashes for both facilities. State facility segment crashes resulted in a higher share of fatality or incapacitating injury than county segment facility crashes. For non-intersection crashes on state facilities, five percent resulted in fatality or incapacitating injury. In comparison, three percent of non-intersection crashes on county facilities resulted in fatality or incapacitating injury.

**Figure 9: State Facility Intersection and Non-Intersection Crashes, Deschutes County (Unincorporated) 2012-2016**



	Intersection	Non-Intersection
Fatal	3	28
Injury A	23	43
Injury B	96	173
Injury C	101	205
PDO	242	576
<b>Fatal/Incapacitating Total Count</b>	<b>26</b>	<b>71</b>

**Figure 10: County Facility Intersection and Non-Intersection Crashes, Deschutes County (Unincorporated) 2012-2016**



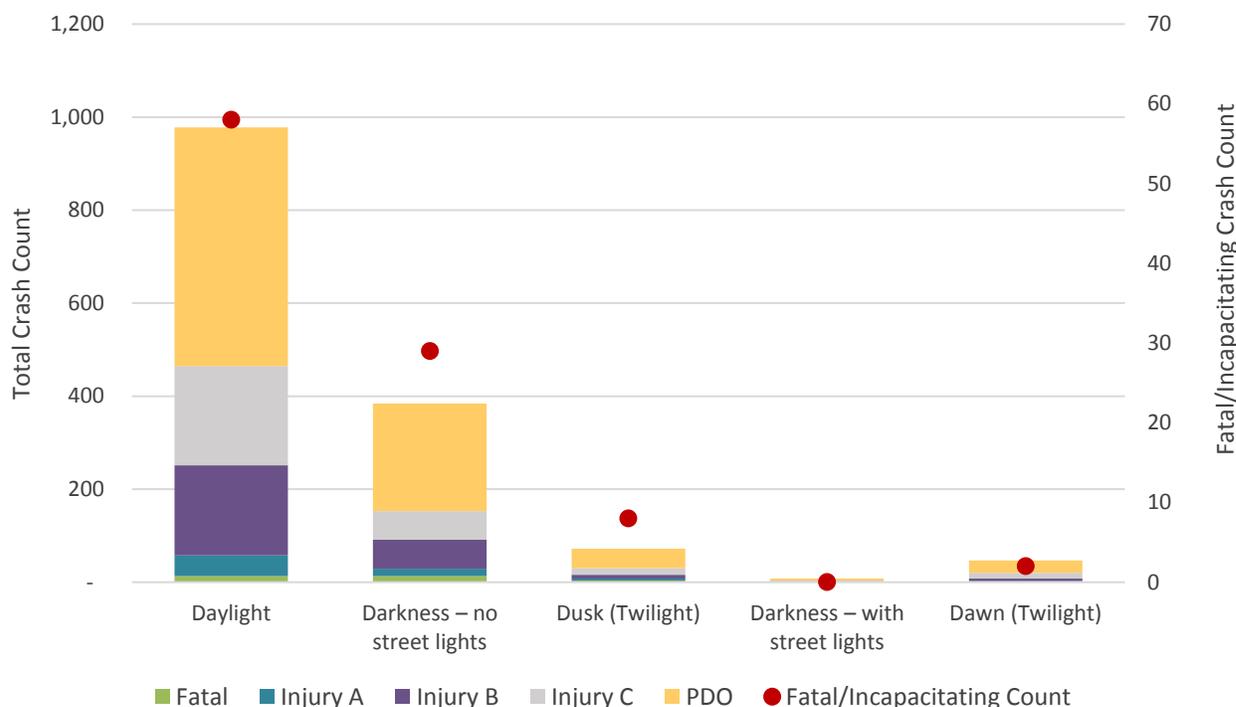
	Intersection	Non-Intersection
Fatal	3	9
Injury A	26	39
Injury B	171	183
Injury C	170	128
PDO	418	372
<b>Fatal/Incapacitating Total Count</b>	<b>29</b>	<b>48</b>

## Crashes by Light Conditions

Reported light conditions for each crash describes the amount of ambient light available at the time of crash. Of the reported crashes, over 60 percent occurred in daylight conditions for state and county facilities.

As shown in Figure 11, 66 percent of crashes on state highways occurred in daylight conditions, and six percent of those were fatal/incapacitating crashes. Approximately 34 percent of crashes occurred in dark, dawn, or dusk conditions. A slightly higher percentage, approximately 40 percent, of fatal/incapacitating crashes occurred in dark, dawn, or dusk conditions.

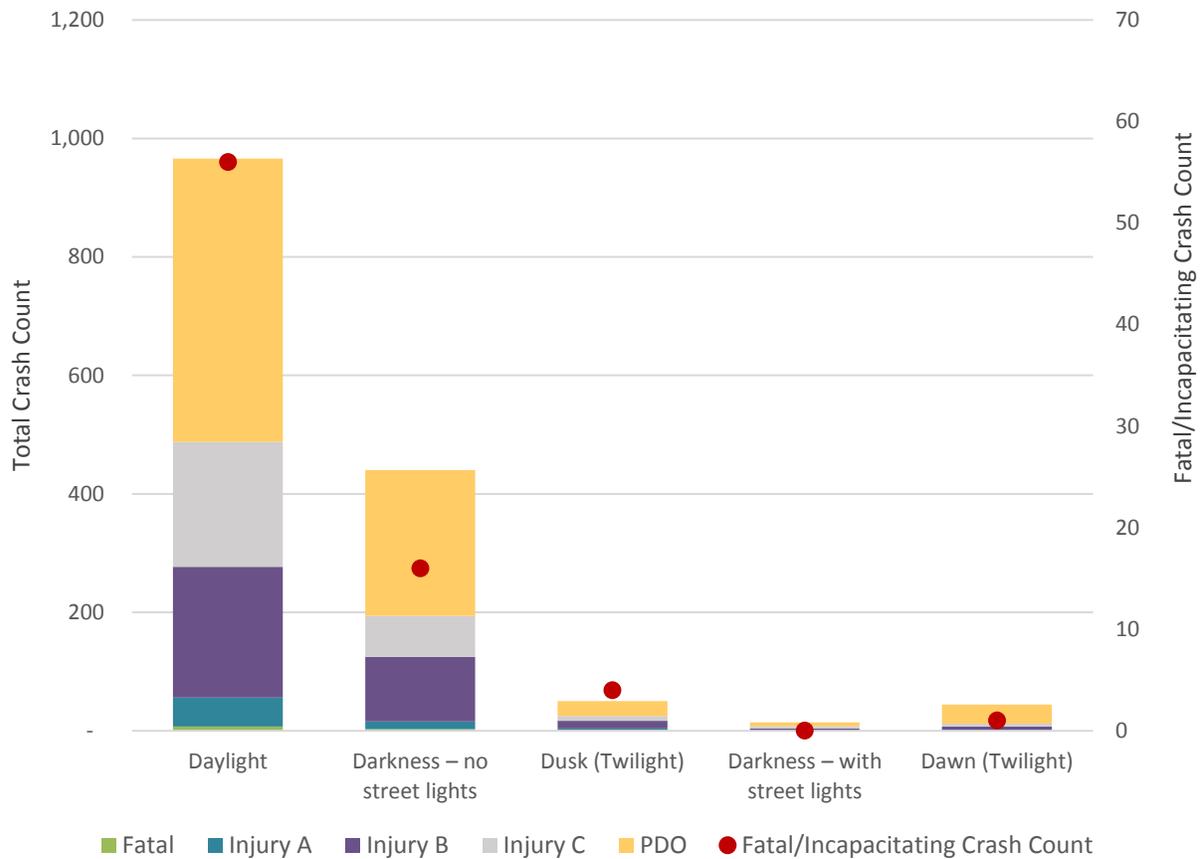
**Figure 11: State Facility Reported Crashes by Lighting Conditions, Deschutes County (Unincorporated) 2012 – 2016**



	Daylight	Darkness – no street lights	Dusk (Twilight)	Darkness – with street light	Dawn (Twilight)
Fatal	13	13	4	-	1
Injury A	45	16	4	-	1
Injury B	193	62	8	-	6
Injury C	214	62	14	4	12
PDO	513	231	42	4	27
Fatal/Incapacitating Total Count	58	29	8	-	2

As shown in, 64 percent of crashes on county highways occurred in daylight conditions, and six percent of those were fatal/incapacitating crashes. Approximately 36 percent of crashes occurred in dark, dawn, or dusk conditions. A slightly lower percentage, approximately 27 percent, of fatal/incapacitating crashes occurred in dark, dawn, or dusk conditions.

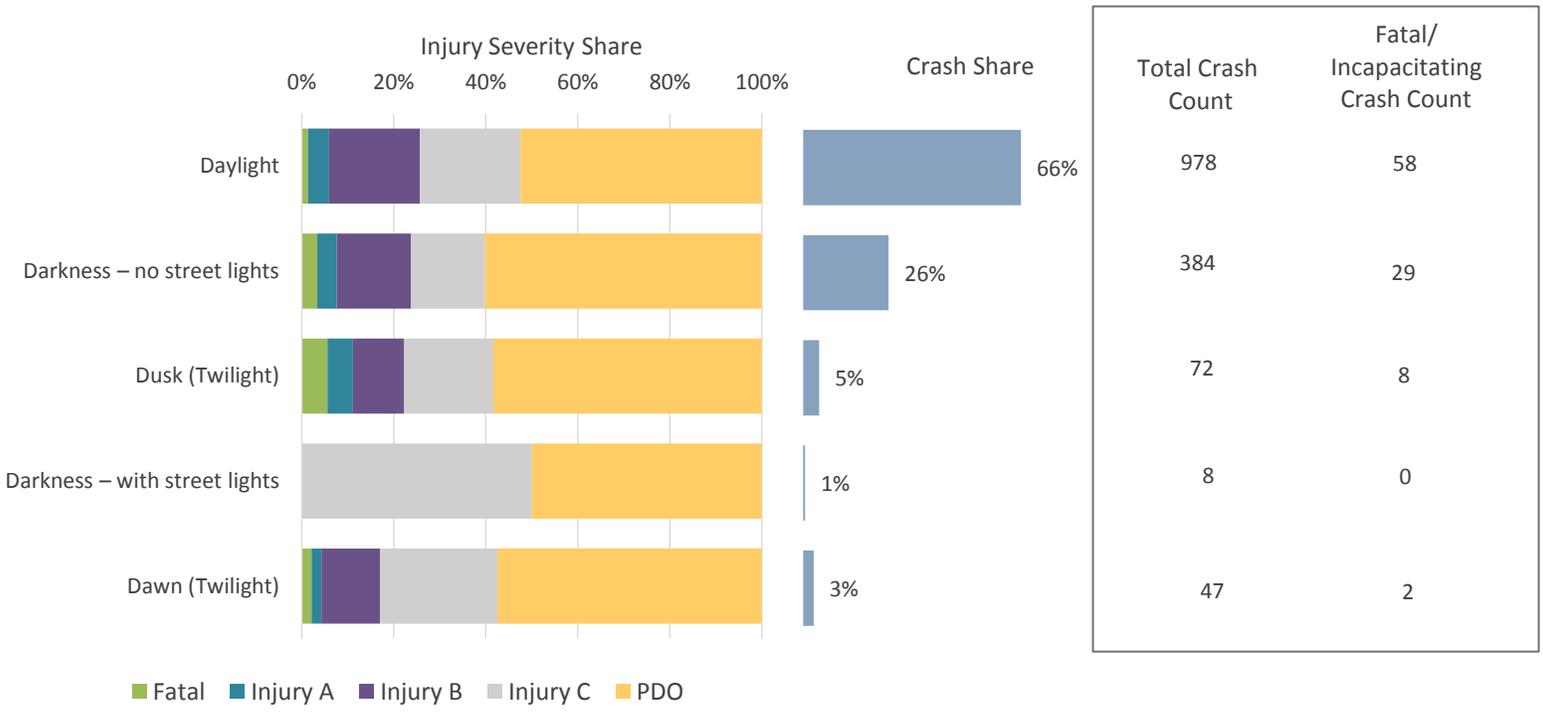
**Figure 12: County Facility Crashes by Lighting Conditions, Deschutes County (Unincorporated) 2012 – 2016**



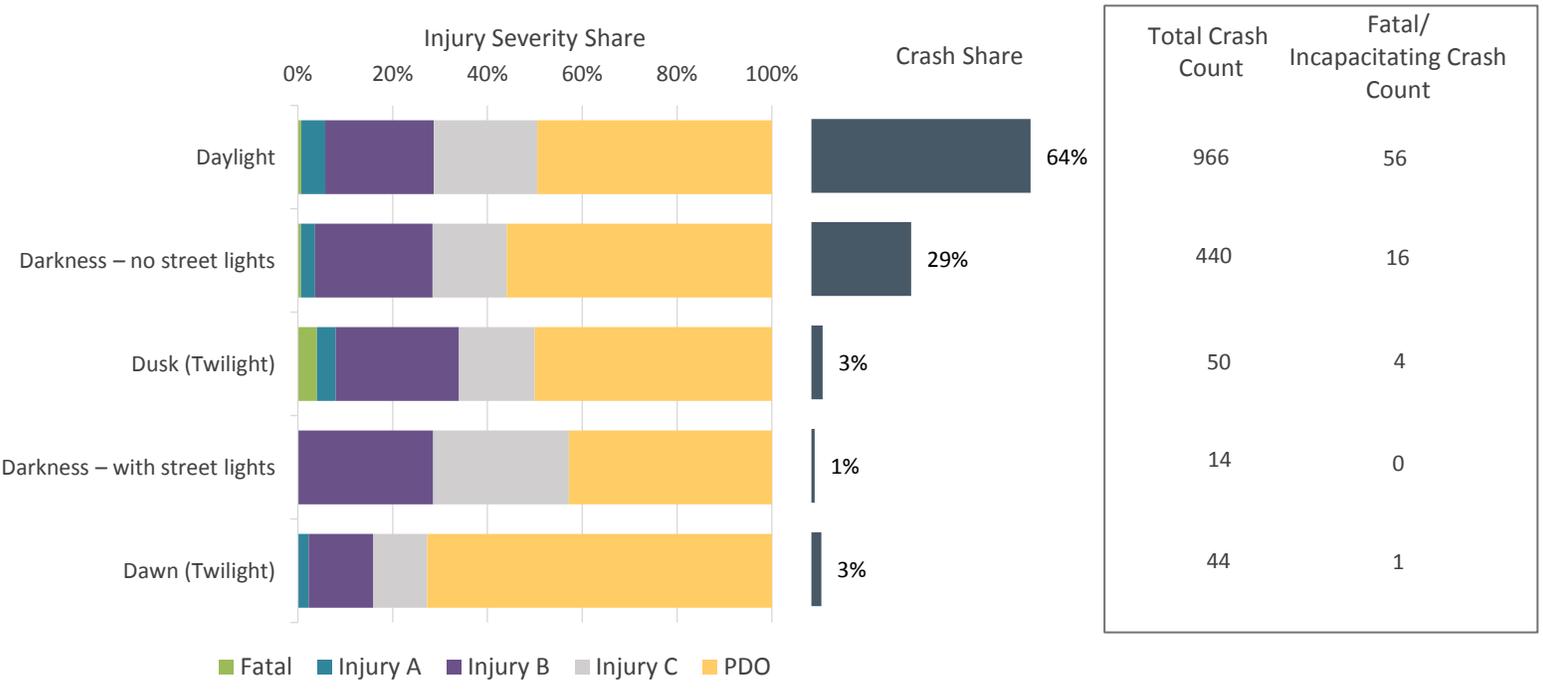
	Daylight	Darkness – no street lights	Dusk (Twilight)	Darkness – with street light	Dawn (Twilight)
Fatal	7	3	2	-	-
Injury A	49	13	2	-	1
Injury B	221	109	13	4	6
Injury C	211	69	8	4	5
PDO	478	246	25	6	32
Fatal/Incapacitating Total Count	56	16	4	-	1

Figure 13 and Figure 14 illustrate the injury severity of crashes by light condition for state and county facilities, respectively. Crashes in dark, unlit conditions on state facilities resulted in fatal or incapacitating injuries more often than those on county facilities.

**Figure 13: State Facility Crash Shares by Lighting Conditions, Deschutes County (Unincorporated) 2012 – 2016**



**Figure 14: County Facility Crash Shares by Lighting Conditions, Deschutes County (Unincorporated) 2012 – 2016**



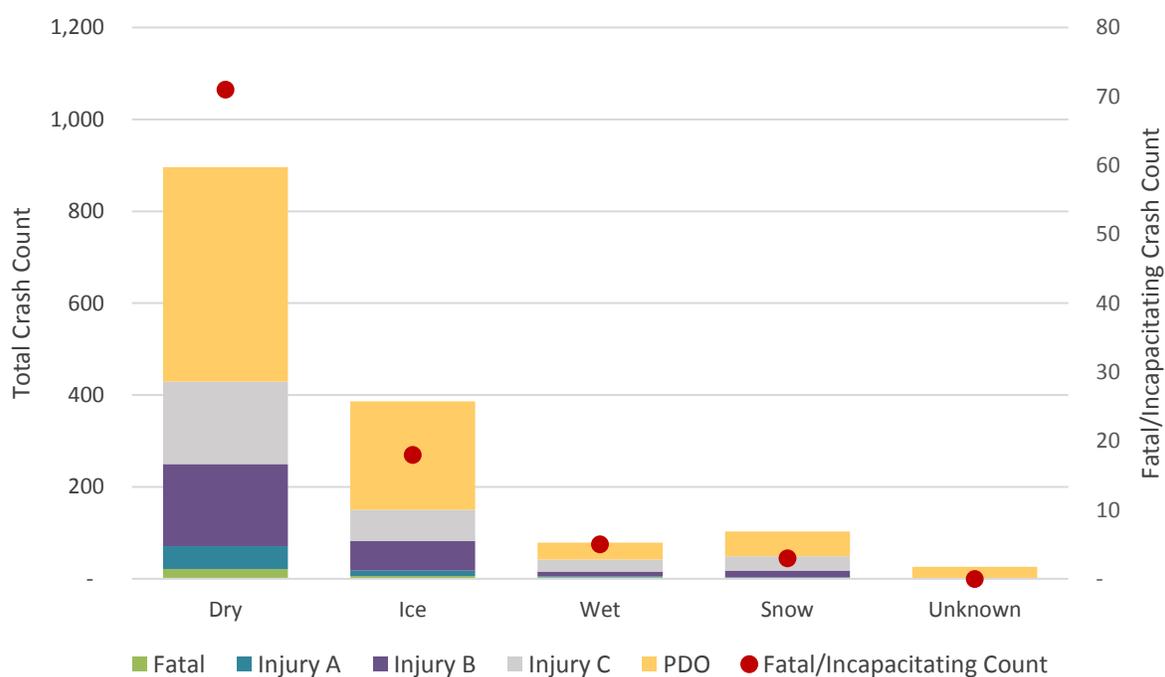
## Road Surface Conditions

Figure 15 and Figure 16 shows the number of crashes by roadway surface condition for state and county facilities, respectively. As shown, a higher percentage of crashes on state highways occurred on snow or ice, compared to county roads.

For state facilities, 33 percent of reported crashes occurred on snow or ice, and five percent occurred on wet roads. Among fatal and incapacitating crashes, 22 percent occurred on snow or ice, and five percent occurred on wet roads. Of the crashes that occurred on snow or ice, eight percent resulted in a fatality or incapacitating injury. Similarly, eight percent of crashes on dry roadways resulted in fatality or incapacitating injury.

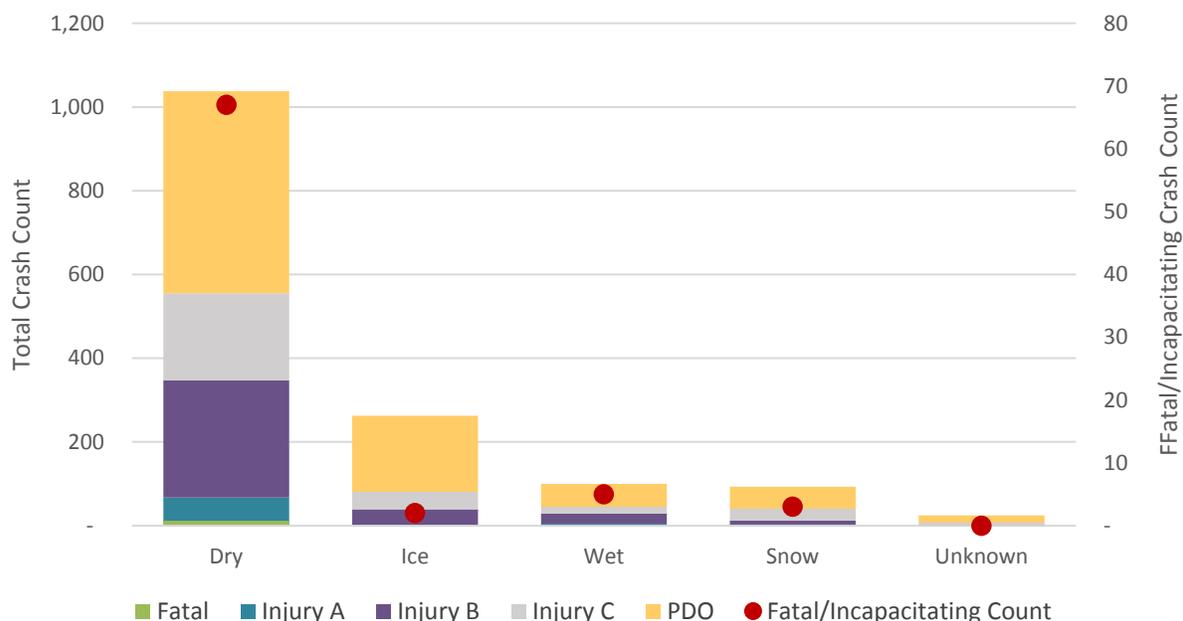
For county facilities, 23 percent of reported crashes occurred on snow or ice, and seven percent occurred on wet roads. Among fatal and incapacitating crashes, seven percent occurred on snow or ice, and six percent occurred on wet roads. Of the crashes that occurred on snow or ice, four percent resulted in a fatality or incapacitating injury, compared to six percent of crashes on dry roads. This indicates that crashes on snow or ice were not more likely to result in fatality or incapacitating injury, compared to those on dry roads.

**Figure 15: State Facility Crashes by Roadway Surface Conditions, Deschutes County (Unincorporated) 2012 – 2016**



	Dry	Ice	Wet	Snow	Unknown
Fatal	21	6	3	1	-
Injury A	50	12	2	2	-
Injury B	179	64	11	15	-
Injury C	179	68	26	31	2
PDO	467	68	26	31	2
Fatal/Incapacitating Total Count	71	18	5	3	-

**Figure 16: County Facility Crashes by Roadway Surface Conditions, Deschutes County (Unincorporated) 2012 – 2016**



	Dry	Ice	Wet	Snow	Unknown
Fatal	12	-	-	-	-
Injury A	55	2	5	3	-
Injury B	280	37	24	10	3
Injury C	208	42	16	28	4
PDO	483	182	55	52	18
Fatal/Incapacitating Total Count	67	2	5	3	-

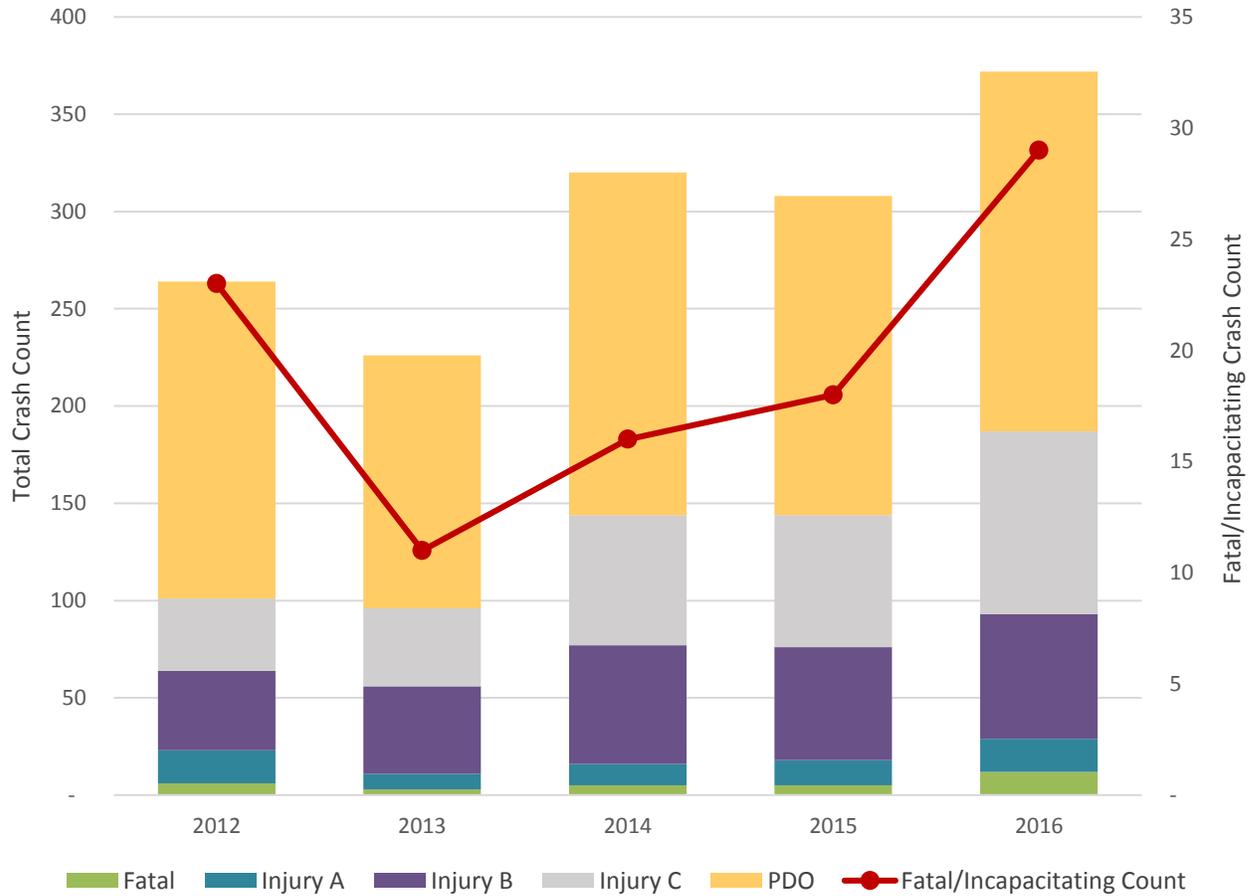
## CRASH SUMMARY BY YEAR, MONTH, DAY, AND TIME

### Crashes by Year

Figure 17 and Figure 18 show the annual crash count for state and county roadways in the County over the five-year study period. As shown, the annual crash count on state highways has generally been increasing over the five-year study period, while the annual crash count on county roadways has held more constant.

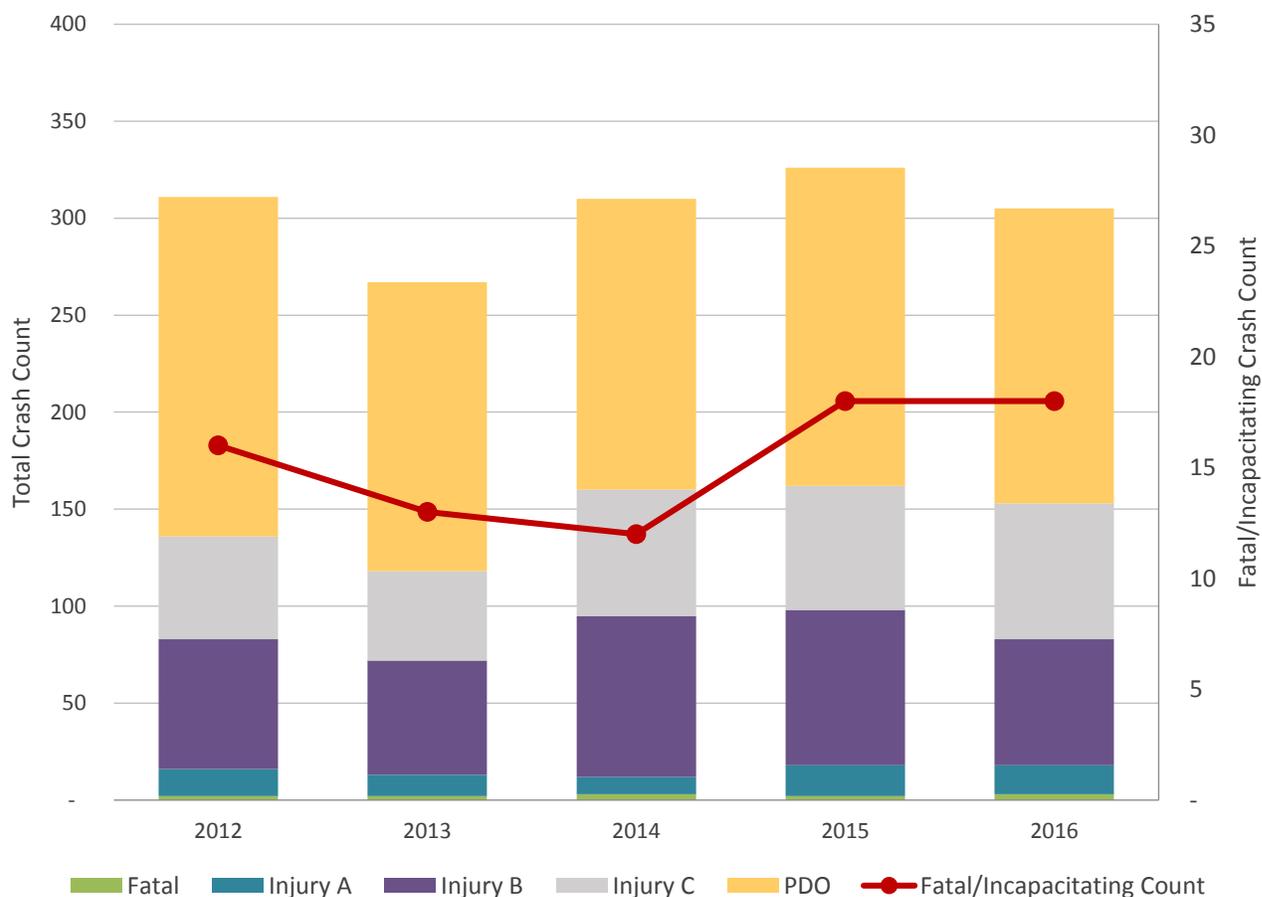
Over the five-year time period, fatal and incapacitating crashes have accounted for between five percent and nine percent of reported crashes each year on state facilities. On county facilities, fatal and incapacitating crashes have accounted for between five and six percent of reported crashes each year.

**Figure 17: State Facility Crashes by Year, Deschutes County (Unincorporated) 2012 – 2016**



	2012	2013	2014	2015	2016
Fatal	6	3	5	5	12
Injury A	17	8	11	13	17
Injury B	41	45	61	58	64
Injury C	37	40	67	68	94
PDO	163	130	176	164	185
Fatal/Incapacitating Total Count	23	11	16	18	29

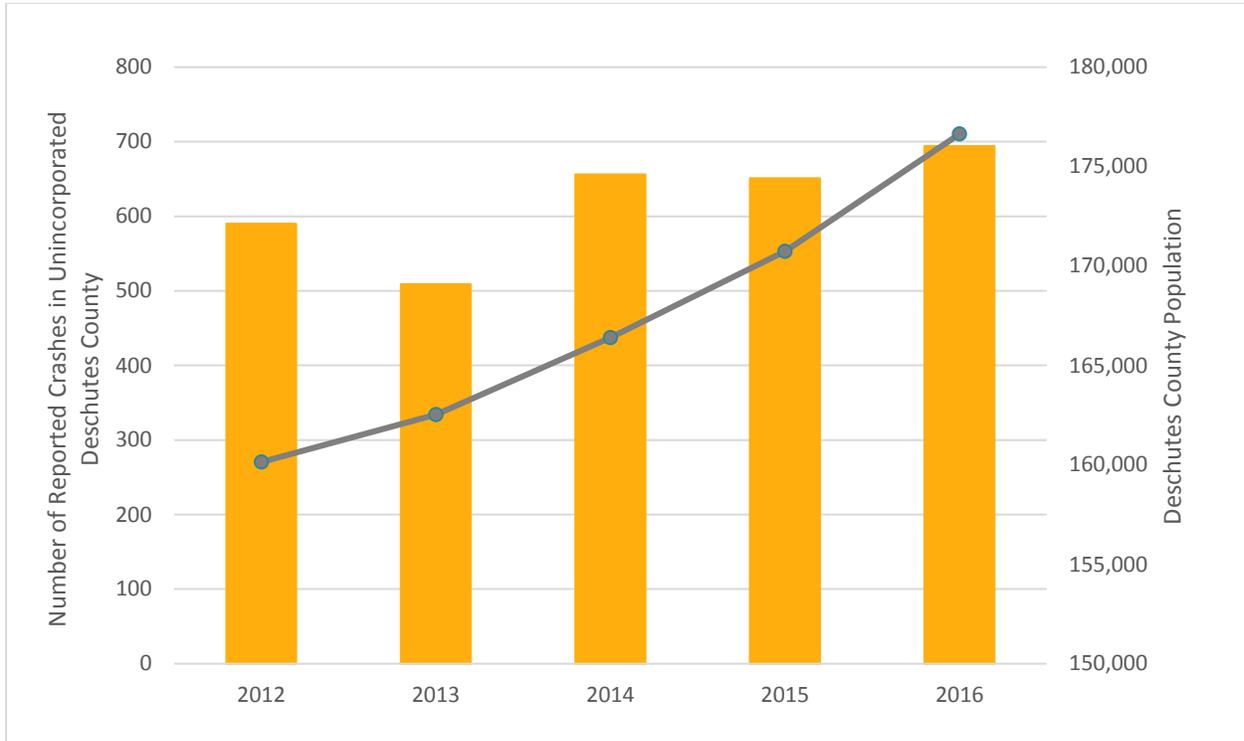
**Figure 18: County Facility Crashes by Year, Deschutes County (Unincorporated) 2012 – 2016**



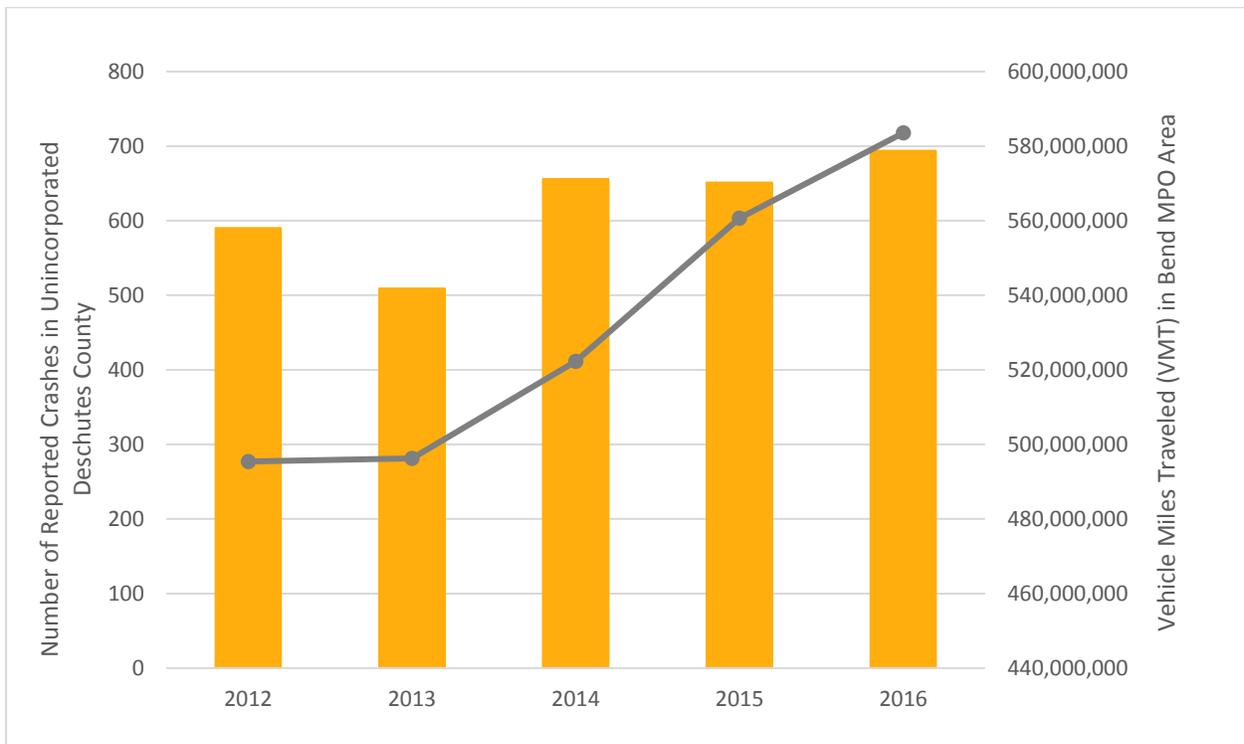
	2012	2013	2014	2015	2016
Fatal	2	2	3	2	3
Injury A	14	11	9	16	15
Injury B	67	59	83	80	65
Injury C	53	46	65	64	70
PDO	175	149	150	164	152
Fatal/Incapacitating Total Count	16	13	12	18	18

Crash frequency is directly correlated to exposure, which can be measured vehicle miles traveled (VMT) and population. To understand how trends in crash frequency by year relate to population and VMT, Figures 19 and 20 illustrate the number of crashes per year in the unincorporated County (all roads) relative to the Deschutes County population and the annual VMT estimates for the Bend MPO area. As shown in the figures, the population and VMT have been on strong increasing trends during the five year study period.

**Figure 19. Unincorporated Deschutes County Crashes (All Roads) and Deschutes County Population by Year**



**Figure 20: Unincorporated Deschutes County Crashes (All Roads) and Bend MPO Area VMT by Year**



\*A VMT estimate is not available for Deschutes County. Therefore, the Bend MPO area VMT estimate was used.

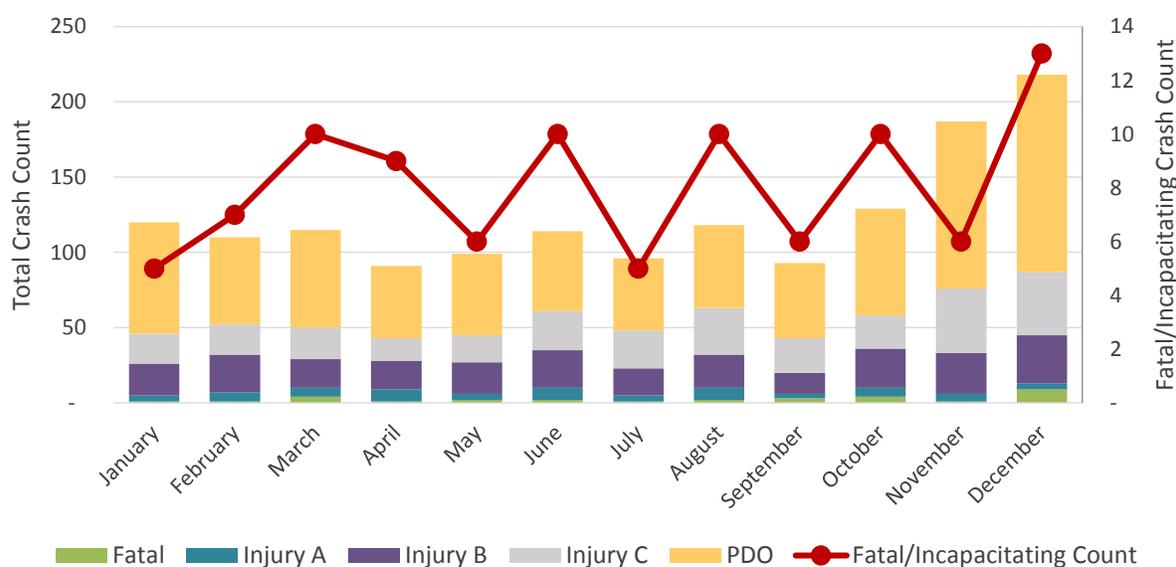
## Crashes by Month

Figure 21 and Figure 22 show the number of crashes by month for state and county facilities. As shown on these figures, the total number of crashes peaks during winter months for both facilities, but the trend among fatal and incapacitating crashes differs between state and county facilities.

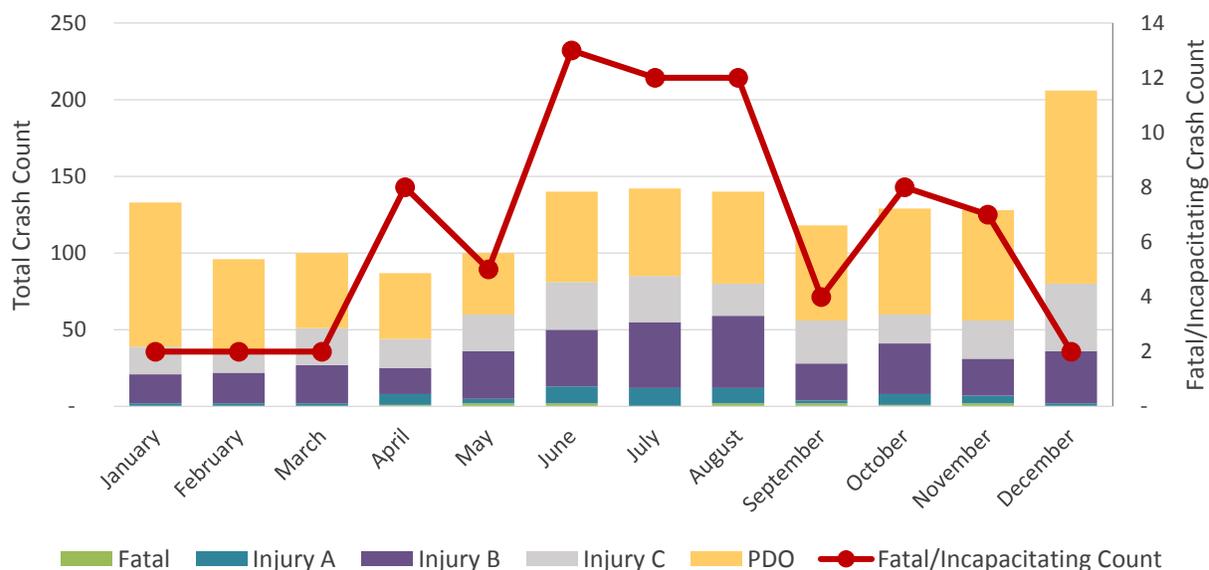
Figure 21 shows that the overall number of reported crashes per month peaks in winter, for state facilities. Fatal and incapacitating crashes on state highways also peaks slightly during the month of December with 13 crashes but fluctuates between five and ten fatal/incapacitating crashes per month for the remainder of the year.

Figure 22 shows the overall number of reported crashes on county facilities also peaks during the month of December but holds relatively constant for the remainder of the year. However, the highest number of fatal/incapacitating crashes occurred during the summer months, between June and August.

**Figure 21: State Facility Crashes by Month, Deschutes County (Unincorporated) 2012 – 2016**



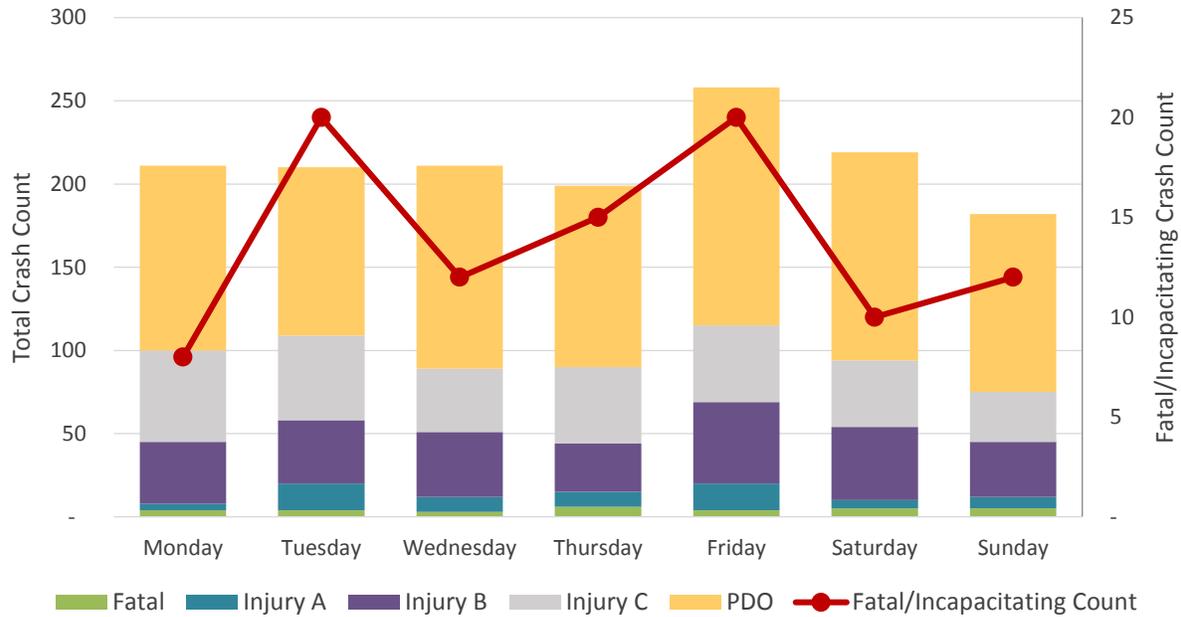
**Figure 22: County Facility Crashes by Month, Deschutes County (Unincorporated) 2012 – 2016**



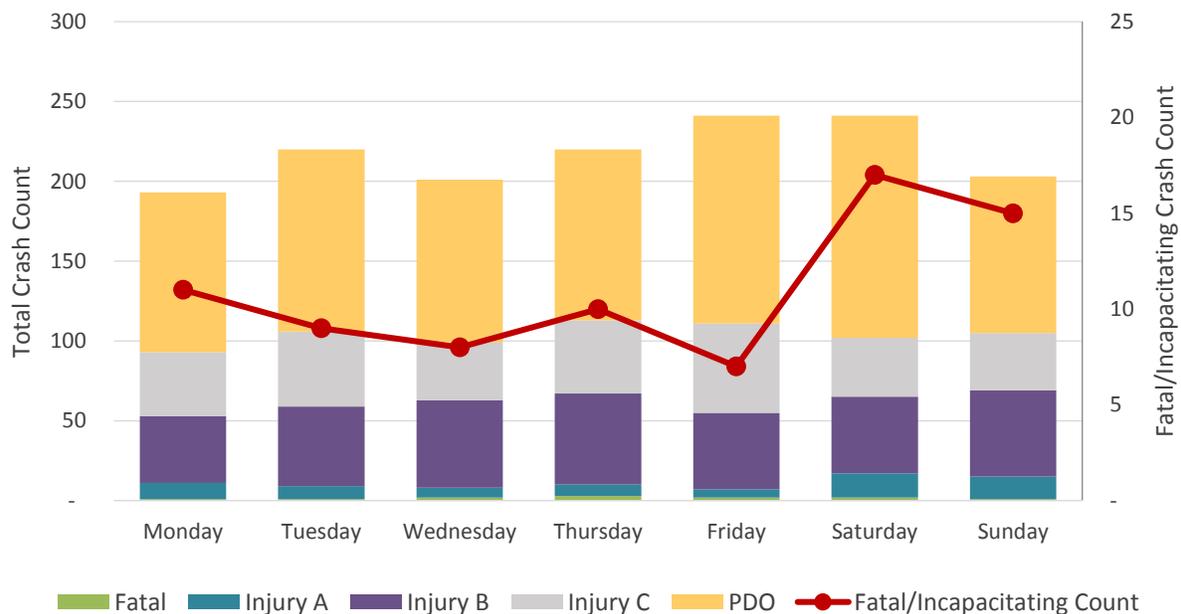
## Crashes by Weekday

Figure 23 and Figure 24 illustrate the crash frequency by weekday for state and county facilities. For state facilities, the total number of reported crashes is relatively consistent throughout the week, with Friday having a slightly higher share of reported crashes compared to other weekdays. The distribution of fatal and incapacitating crashes by weekday does not show strong trends. The total number of reported crashes on county facilities is also relatively consistent throughout the week. However, the number of fatal and incapacitating crashes per day is highest on the weekend, on Saturday and Sunday.

**Figure 23: State Facility Crashes by Weekday, Deschutes County (Unincorporated) 2012 – 2016**



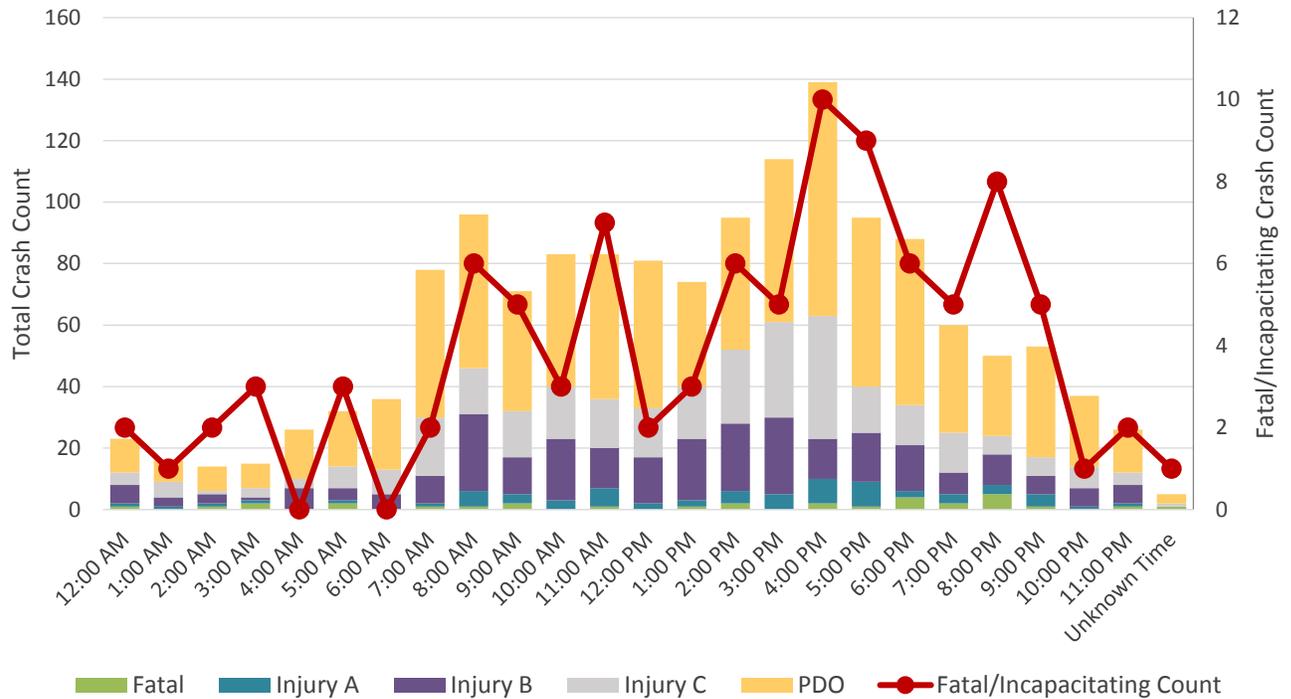
**Figure 24: County Facility Crashes by Weekday, Deschutes County (Unincorporated) 2012 – 2016**



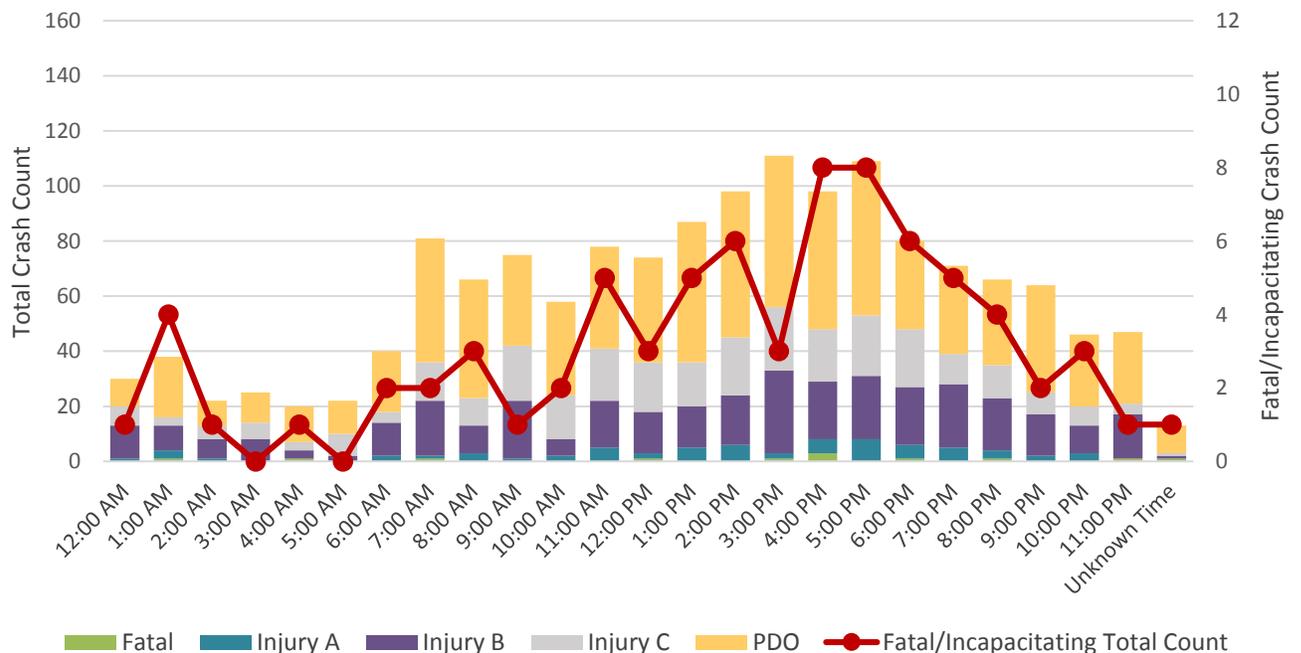
## Crashes by Time of Day

Figure 25 and Figure 26 illustrate the crash distribution by time of day for state and county facilities. On both facility types, the distribution of all reported crashes and fatal/incapacitating crashes peaks during the late afternoon and early evening time period, between 3:00 and 6:00 pm.

**Figure 25: State Facility Crashes by Time of Day, Deschutes County (Unincorporated) 2012 – 2016**



**Figure 26: County Facility Crashes by Time of Day, Deschutes County (Unincorporated) 2012 – 2016**



## COLLISION TYPE AND CONTRIBUTING FACTORS

### Collision Type

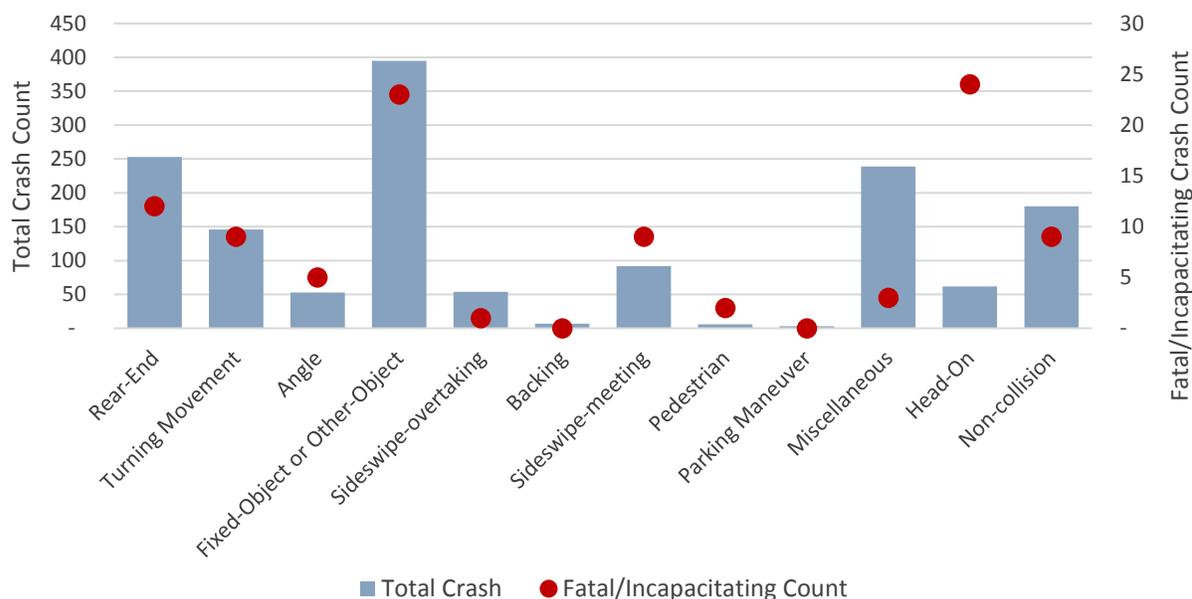
Collision type is reported at two levels of detail in the crash database. The first, classified in the data as *collision type*, includes broad categories like *rear-end* or *angle*. The *non-collision* crash type refers to crashes involving a single vehicle, which includes overturn crashes. The *miscellaneous* crash type most commonly refers to *animal* crashes. Crashes involving pedestrians are listed as a pedestrian-specific crash type, but those involving bicycles are distributed among all crash types and not specifically identified.

The second level of detail is classified as *crash type* and provides more specific detail. For example, *angle* collisions would be further classified by type as *entering at angle*, *parked motor vehicle*, *one vehicle stopped*, or similar descriptions. For purposes of discussion, trends are compared at the broader *collision type* level, and additional detail is described as needed.

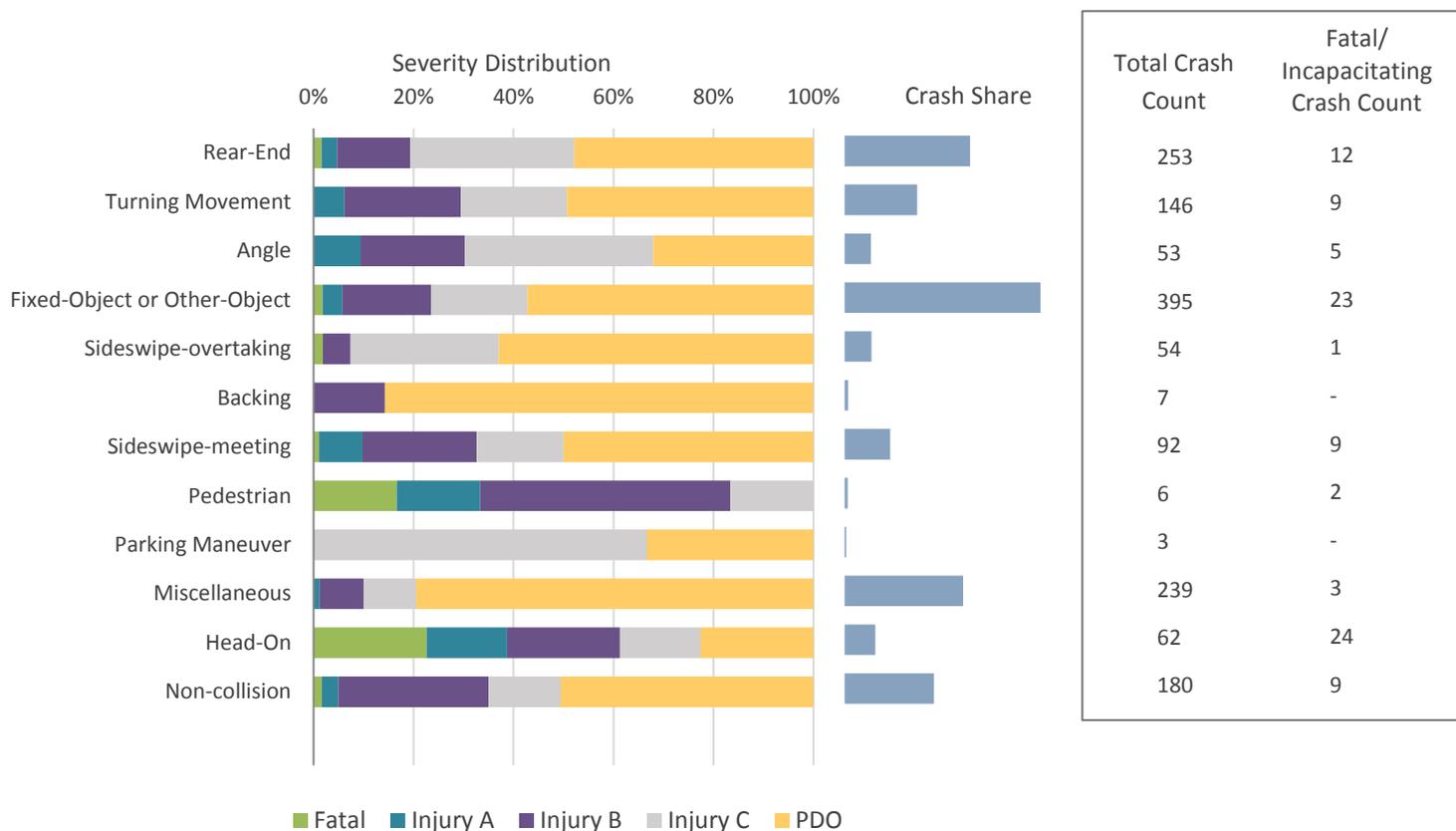
On state highways, shown in Figure 27, the most common collision types were *fixed object*, *rear-end*, *miscellaneous (animal)*, and *non-collision (overturn)*. The more detailed *crash type* field indicated that 94 percent of these *non-collision* crashes were *overturn* crashes, and 95 percent of these *miscellaneous* crashes were *animal* crashes.

When considering the total count of only fatal and incapacitating crashes, also shown in Figure 27, the most common collision types are *head-on*, *fixed-object*, *rear-end*, *turning movement*, *sideswipe meeting*, and *non-collision*. Figure 28 shows the severity distribution for the crashes by collision type. As shown in this figure, *head-on* collisions and *pedestrian* collisions are most likely to result in fatality or incapacitating injury when they do occur. On state highways, *head-on* collisions accounted for 39 percent of fatal or incapacitating injury crashes.

Figure 27: State Facility Crashes by Collision Type and Severity, Deschutes County (Unincorporated) 2012 – 2016



**Figure 28: State Facility Crash Share by Collision Type and Severity, Deschutes County (Unincorporated), 2012-2016**

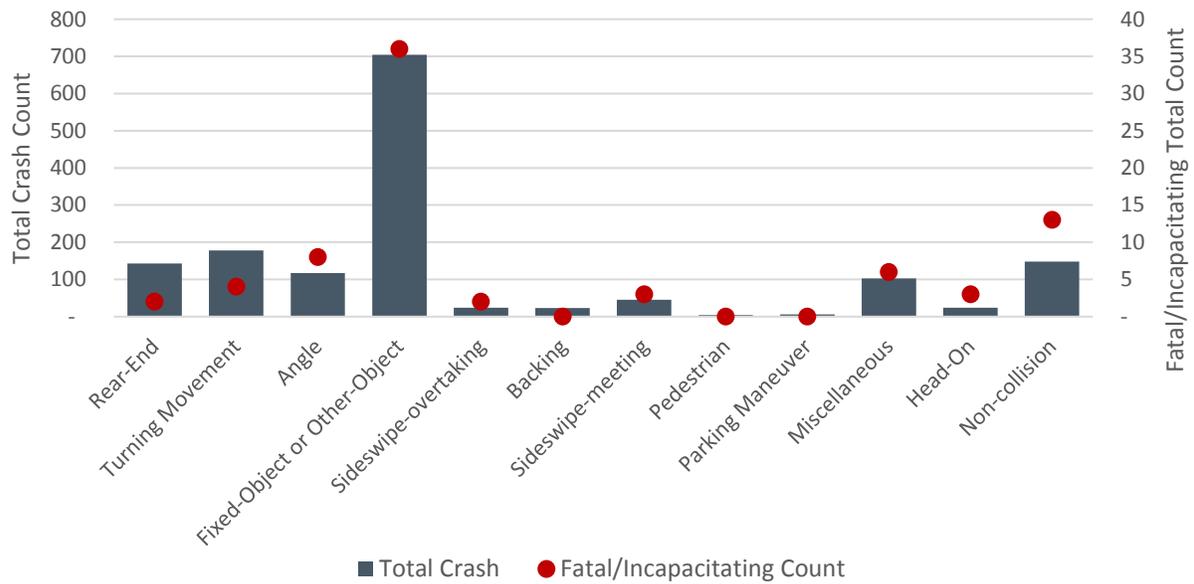


On county roadways, shown in Figure 29, *fixed object* crashes were the most common, followed by *turning movement*, *rear-end*, *non-collision (overturn)*, *angle*, and *miscellaneous (animal)*. The more detailed crash type field indicated that 98 percent of *non-collision* crashes on county roads were *overturn* crashes, and 96 percent of *miscellaneous* crashes were *animal* crashes.

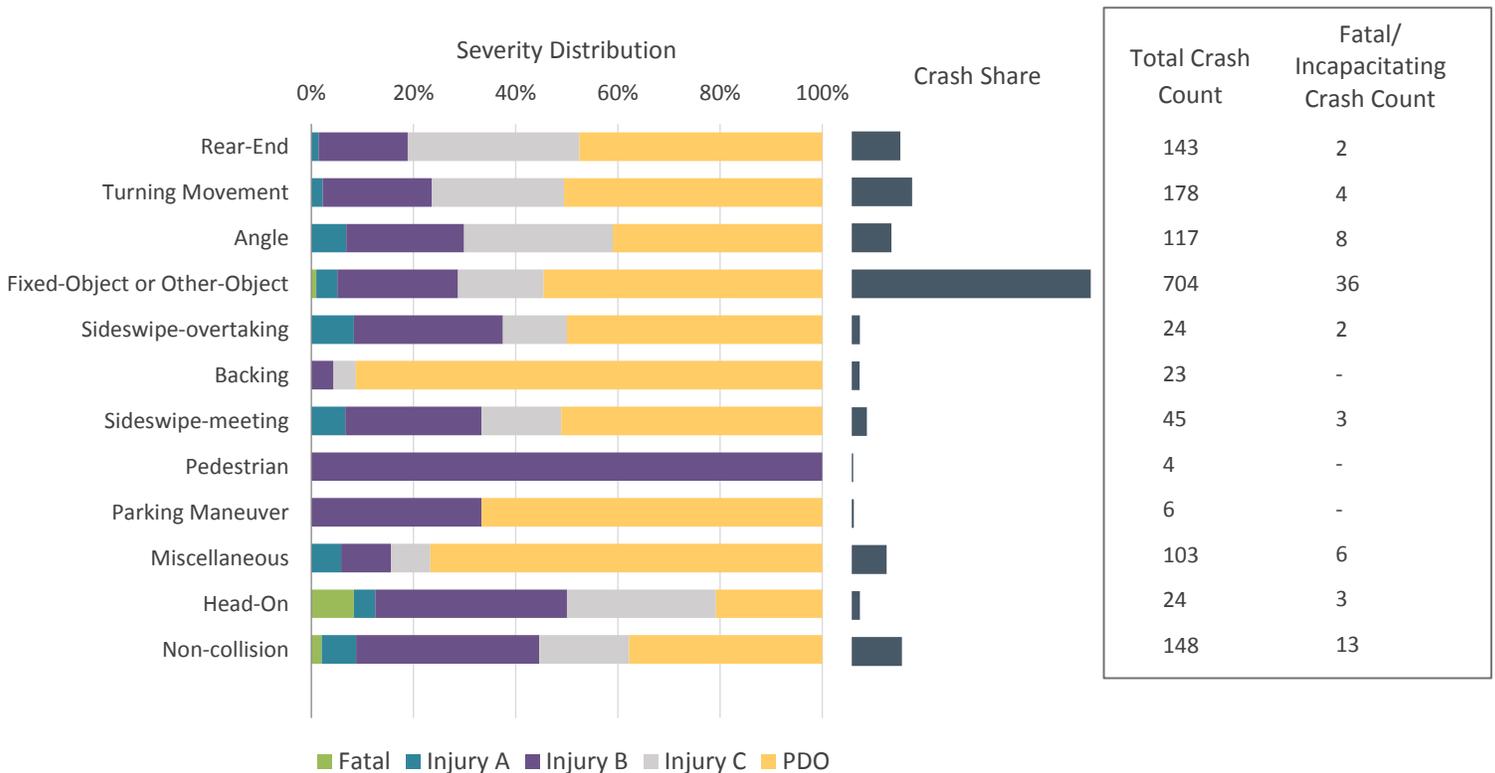
When considering the total count of only fatal and incapacitating crashes, also shown in Figure 29, the most common collision types are *fixed-object*, *non-collision*, *angle*, and *miscellaneous (animal)*.<sup>4</sup> Figure 30 shows the severity distribution for the crashes by collision type. As shown in this figure, *head-on* collisions and *non-collision (rollover)* crashes are most likely to result in fatality or incapacitating injury when they do occur. The figure also shows that *backing* crashes and *miscellaneous (animal)* crashes are most likely to be property damage only crashes, not resulting in injuries.

<sup>4</sup> Collisions involving animals are coded as *miscellaneous* in the collision type field. However, closer evaluation of the data indicates that the majority of *miscellaneous* collisions are animal crashes.

**Figure 29: County Facility Crashes by Collision Type and Severity, Deschutes County (Unincorporated) 2012 - 2016**



**Figure 30: County Facility Crash Share by Collision Type and Severity, Deschutes County (Unincorporated), 2012-2016**



The statewide Oregon TSAP identifies intersection crashes and roadway departure crashes as emphasis areas for the state.

*Turning movement, angle, and rear-end* crashes are typically associated with intersections. Of the 452 reported *rear-end, turning movement, and angle* crashes on state facilities, 20 percent resulted in fatality or incapacitating injury. Of the 438 reported *rear-end, turning movement, and angle* crashes on county facilities, ten percent resulted in fatality or incapacitating injury.

Roadway departure crashes, or lane departure crashes, include those in which vehicles leave their travel lane: *fixed object or other object, head-on, sideswipe, and non-collision (rollover)*. On state highways, roadway departure crash types accounted for 68 percent of all reported fatal or incapacitating injury crashes. On county facilities, roadway departure crashes accounted for 75 percent of fatal or incapacitating injury crashes.

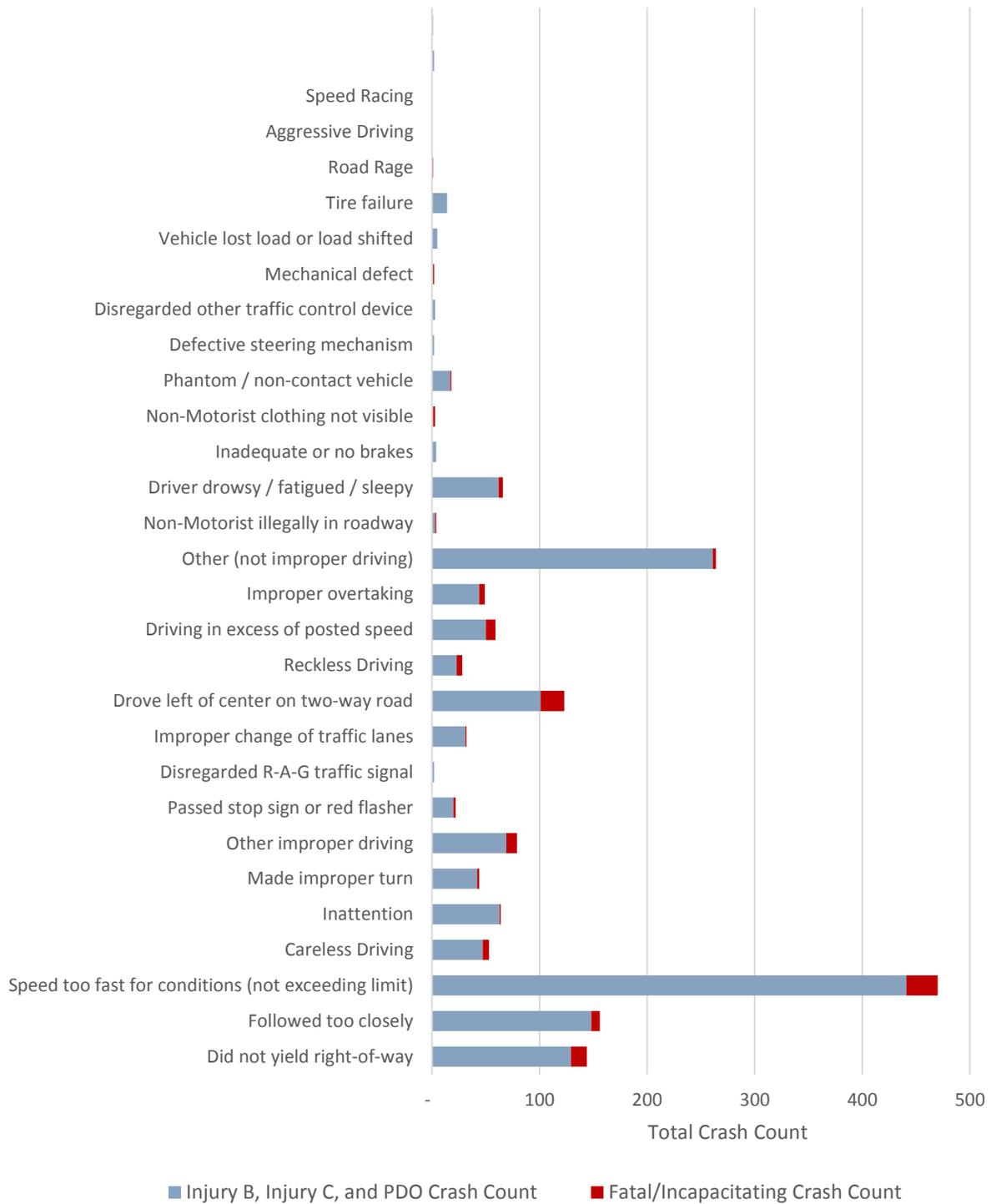
## Contributing Factors

Figure 31 and Figure 32 summarizes the reported contributing factors for the crashes for state and county roadways. For each crash, the corresponding officer codes up to three contributing factors. For example, a crash may be recorded as caused by a driver failing to yield the right-of-way and caused by reckless driving. For this analysis, each crash is counted by all applicable contributing factors. Thus, the totals in the figures may total more than the number of reported crashes.

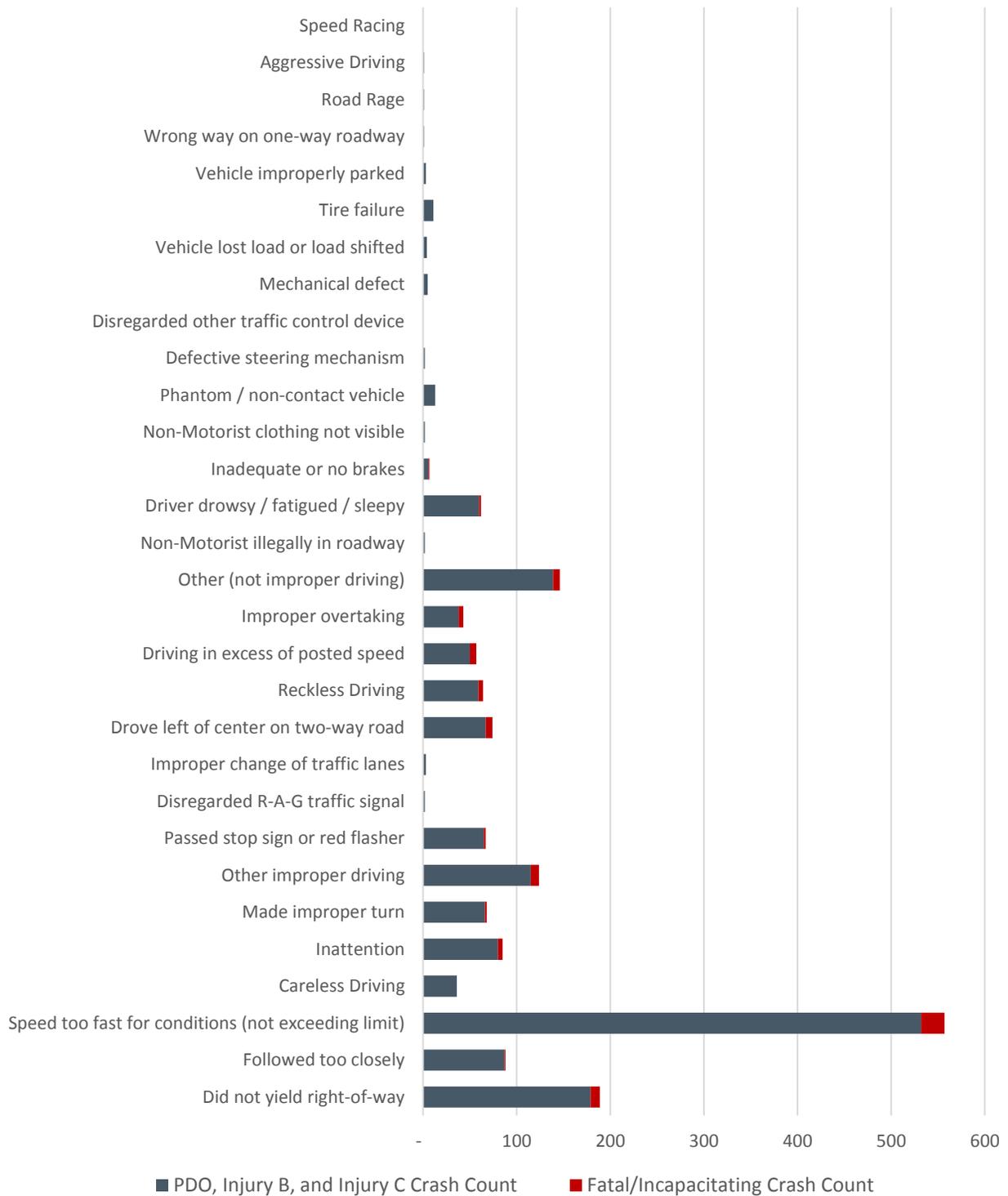
On both state and county roads, the most common contributing factors included *speed too fast for conditions, other (not improper driving), and did not yield right of way*. On state highways, *followed too closely and drove left of center on two-way road* were also common reported contributing factors.

Aggressive driving crashes include those associated with speed (too fast for conditions and exceeding the limit) and following too closely. Aggressive driving crashes among fatal and incapacitating crashes were most common in summer months, between June and August, when fatal/incapacitating crashes were most common on County roads.

**Figure 31: State Facility Crashes by Cause and Severity, Deschutes County (Unincorporated) 2012 – 2016**



**Figure 32: County Facility Crashes by Cause and Severity, Deschutes County (Unincorporated) 2012 – 2016**



## BEHAVIORAL CHARACTERISTICS

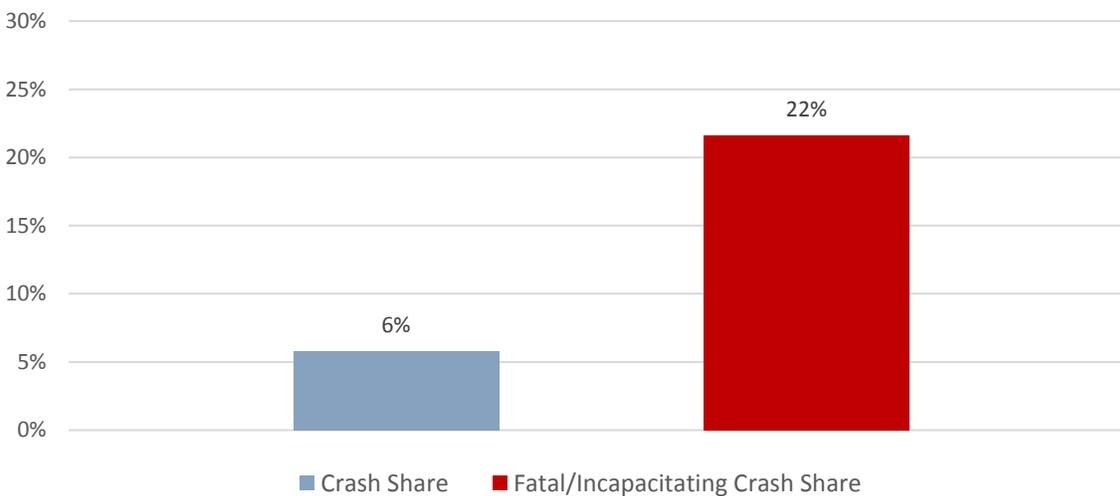
This section summarizes crash characteristics associated with driver behavior or driver characteristics. Although issues with some of these characteristics can be addressed through engineering treatments, these are often best addressed through education and enforcement programs targeted at behaviors.

### Alcohol and Drug Crashes

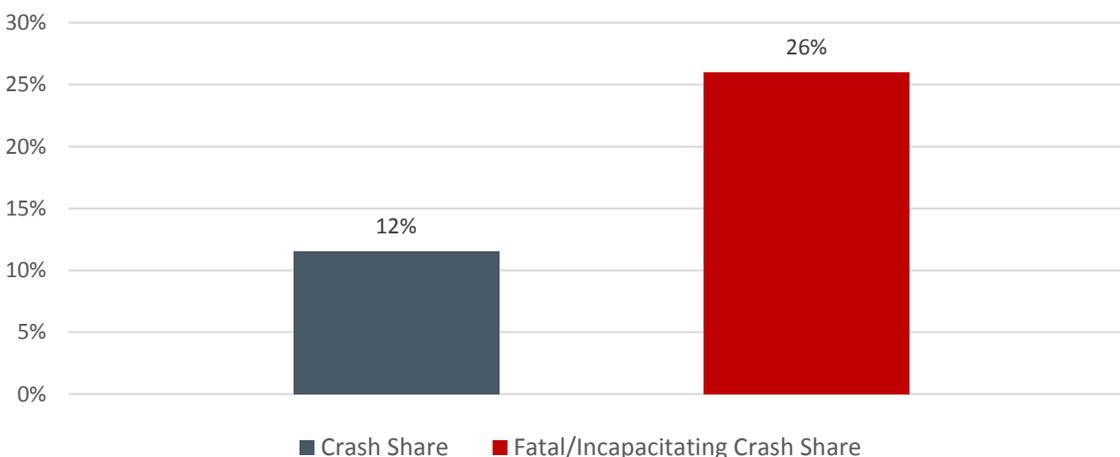
The influence of alcohol and drug use in reported crashes is coded in the crash data from the officer's assessment. In the case of drug use, a crash would be flagged if drug use is reported by the police, by test results, or if the suspect admits use. A flag in the data for alcohol use would occur from observations at the scene, breath or field sobriety tests, or conclusions in the reporting officer's narrative. The two flags are combined for summary here.

As shown in Figure 33, six percent of reported crashes on state highways involved alcohol or drugs, and 22 percent of fatal/incapacitating crashes involved alcohol or drugs. As shown in Figure 34, 12 percent of reported crashes on county roads involved alcohol or drugs, and 26 percent of fatal/incapacitating crashes involved alcohol or drugs. Figure 35 and Figure 36 show that crashes involving alcohol or drugs on both state and county roads were more likely to result in injury than those that did not involve impaired driving.

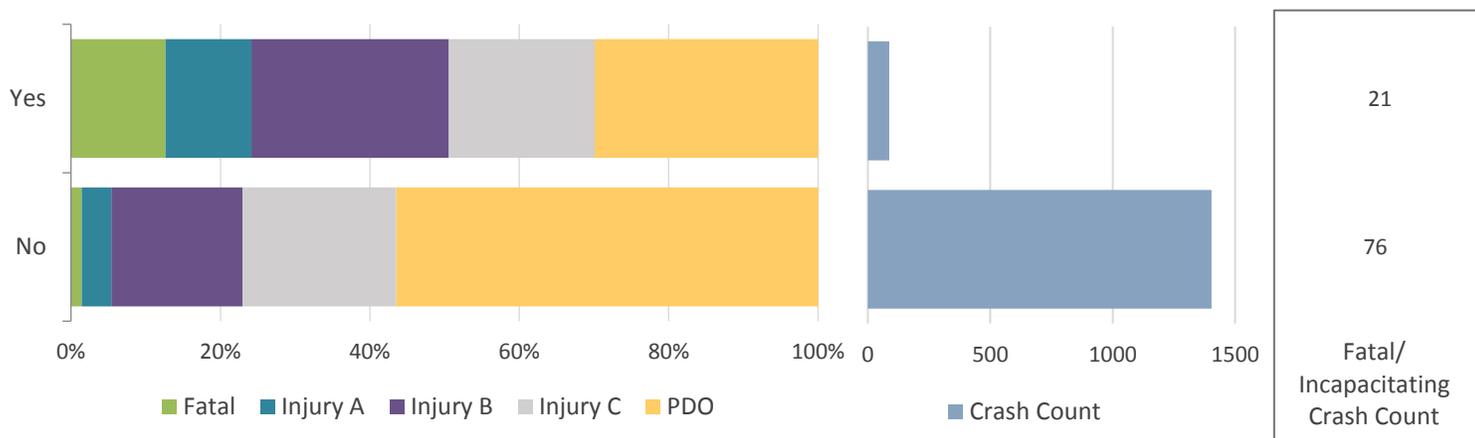
**Figure 33: State Facility by Alcohol and Drug Crashes, Deschutes County (Unincorporated) 2012 – 2016**



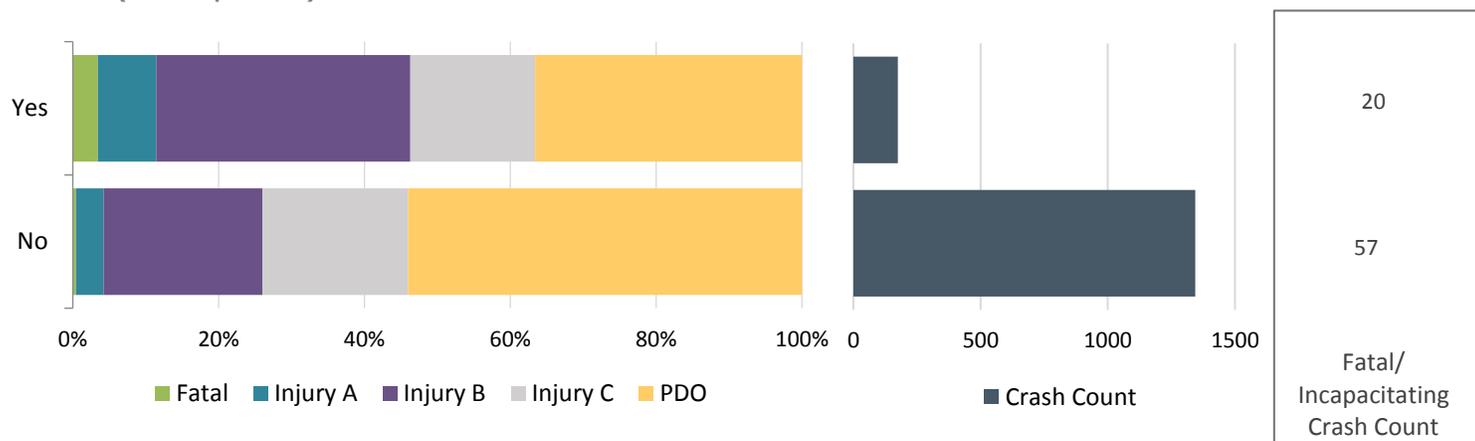
**Figure 34: County Facility by Alcohol and Drug Crashes, Deschutes County (Unincorporated) 2012 – 2016**



**Figure 35: State Facility by Injury Severity of Alcohol and Drug Crashes, Deschutes County (Unincorporated) 2012 – 2016**



**Figure 36: County Facility Crashes by Injury Severity of Alcohol and Drug Crashes, Deschutes County (Unincorporated) 2012 – 2016**



## Speeding

Speeding is captured in two separate contributing factors as discussed above (exceeding the posted speed limit and traveling too fast for conditions). ODOT summarizes this data in an “excessive speeding” flag to identify crashes associated with speed as a factor. As shown in Table 2 and Table 3, excessive speeds were flagged in 38 percent of reported crashes for state roads and 42 percent of reported crashes for county roads. On state roads, this share is higher among fatal and incapacitating crashes; 43 percent of fatal/incapacitating crashes involved excessive speed.

**Table 2: State Facility Excessive Speeding Crashes, Deschutes County (Unincorporated) 2012 – 2016**

Excessive Speed Flag	Fatal	Injury A	Injury B	Injury C	PDO	Fatal & Injury A Total	Total
No	16	39	150	196	517	55 (57%)	918 (62%)
Yes	15	27	119	110	301	42 (43%)	572 (38%)
<b>Total</b>	<b>31</b>	<b>66</b>	<b>269</b>	<b>306</b>	<b>818</b>	<b>97</b>	<b>1,490</b>

**Table 3: County Facility Excessive Speeding Crashes, Deschutes County (Unincorporated) 2012 – 2016**

Excessive Speed Flag	Fatal	Injury A	Injury B	Injury C	PDO	Fatal & Injury A Total	Total
No	4	41	205	175	463	<b>45 (58%)</b>	<b>888 (58%)</b>
Yes	8	24	149	123	327	<b>32 (42%)</b>	<b>631 (42%)</b>
<b>Total</b>	<b>12</b>	<b>65</b>	<b>354</b>	<b>298</b>	<b>790</b>	<b>77</b>	<b>1,519</b>

## Safety Equipment Use

Crash data indicates the number of participants in a crash who used and did not use safety equipment. Safety equipment includes a variety of items including seat belts, child seats, booster seats, and bike helmets. For both state and county roads, crashes were more likely to result in injury when at least one participant was not using safety equipment.

Based on this data, shown in Table 4, 20 percent of fatal/incapacitating crashes on state facilities involved at least one participant who was not using safety equipment. Of the state facility crashes that involved participant(s) not using safety equipment, 80 percent resulted in injury. In comparison, 44 percent of crashes in which all participants used safety equipment resulted in some level of injury, and five percent resulted in fatal or incapacitating injury.

As shown in Table 5, of the county facility crashes that involved participant(s) not using safety equipment, 84 percent resulted in some level of injury. Eighteen percent of fatal/incapacitating crashes on county facilities involved at least one participant who was not using safety equipment. In comparison, 46 percent of county facility crashes in which all participants used safety equipment resulted in some level of injury, and four percent resulted in fatal or incapacitating injury.

**Table 4: State Facility Crashes by Safety Equipment Usage, Deschutes County (Unincorporated) Crashes 2012-2016**

	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal/Incapacitating Total
Safety equipment used by all participants	22	56	258	296	808	1,440 (97%)	78 (80%)
Safety equipment not used by at least one participant	9	10	11	10	10	50 (3%)	19 (20%)
<b>Total</b>	<b>31</b>	<b>66</b>	<b>269</b>	<b>306</b>	<b>818</b>	<b>1,490</b>	<b>97</b>

**Table 5: County Facility Crashes by Safety Equipment Usage, Deschutes County (Unincorporated) Crashes 2012-2016**

	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal/Incapacitating Total
Safety equipment used by all participants	8	55	325	284	779	1,451 (96%)	63 (82%)
Safety equipment not used by at least one participant	4	10	29	14	11	68 (4%)	14 (18%)
<b>Total</b>	<b>12</b>	<b>65</b>	<b>354</b>	<b>298</b>	<b>790</b>	<b>1,519</b>	<b>77</b>

## VULNERABLE ROAD USERS

Roadways have been predominately designed for automobiles which makes vulnerable road users more susceptible to fatalities and injuries. Vulnerable road users can include pedestrians, bicyclists, motorcyclists, and others. Engineering, education and enforcement are potential countermeasures to protecting the safety of vulnerable road users.

### Pedestrian Crashes

As noted in the collision type discussion, pedestrian crashes constitute a relatively low share of overall crashes in Deschutes County. Pedestrian crashes accounted for less than one percent of crashes in the unincorporated County area and one percent of fatal/incapacitating crashes. However, when pedestrians are involved in crashes, the results are more likely to be severe than in crashes involving only vehicles.

Six pedestrian crashes were reported on state highways in the unincorporated County, including one fatal, one incapacitating injury, three moderate injury, and one minor injury crash. On the county system, four moderate injury pedestrian crashes were reported.

The two most common pedestrian actions noted for pedestrian crashes were *non-motorist illegally in the roadway* (reported in four state facility and two county facility crashes), and *non-motorist clothing was not visible* (reported in three state facility and two county facility crashes). Multiple actions were reported with some crashes.

### Bicycle Crashes

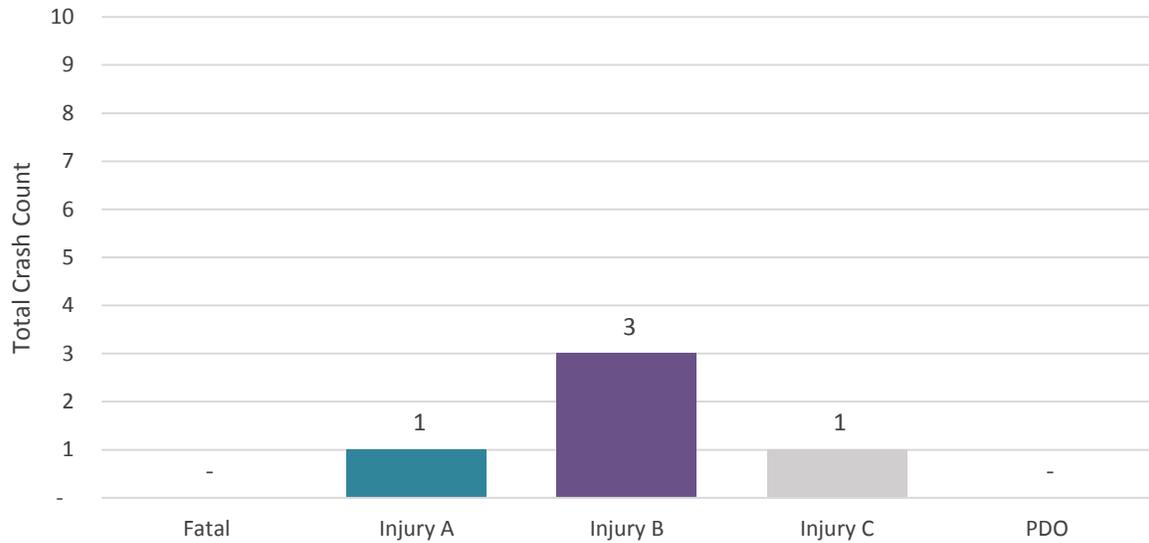
Bicyclists also represent a vulnerable segment of the road user population. Bicyclist crashes accounted for less than one percent of total crashes in the County and approximately three percent of fatal/incapacitating crashes.

As shown in Figure 37, five bicyclist crashes were reported on state facilities between 2012 and 2016. These five crashes each resulted in some level of injury. One of the 5 crashes (20 percent) resulted in an incapacitating injury.

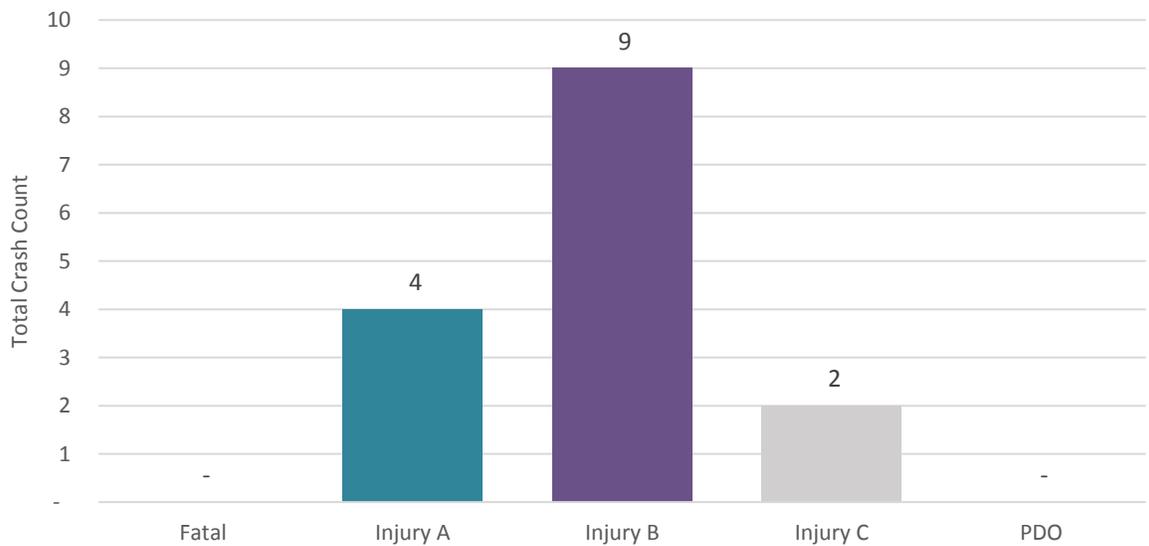
As shown in Figure 38, 15 bicyclist crashes were reported on county facilities between 2012 and 2016. These four crashes each resulted in some level of injury, four of which (27 percent) resulted in an incapacitating injury.

The most commonly reported contributing action for bicyclist crashes was *did not yield right-of-way* (reported in 40 percent of state facility crashes and 47 percent of county facility crashes).

**Figure 37: State Facility Bicyclist Crashes by Severity, Deschutes County (Unincorporated) 2012 – 2016**



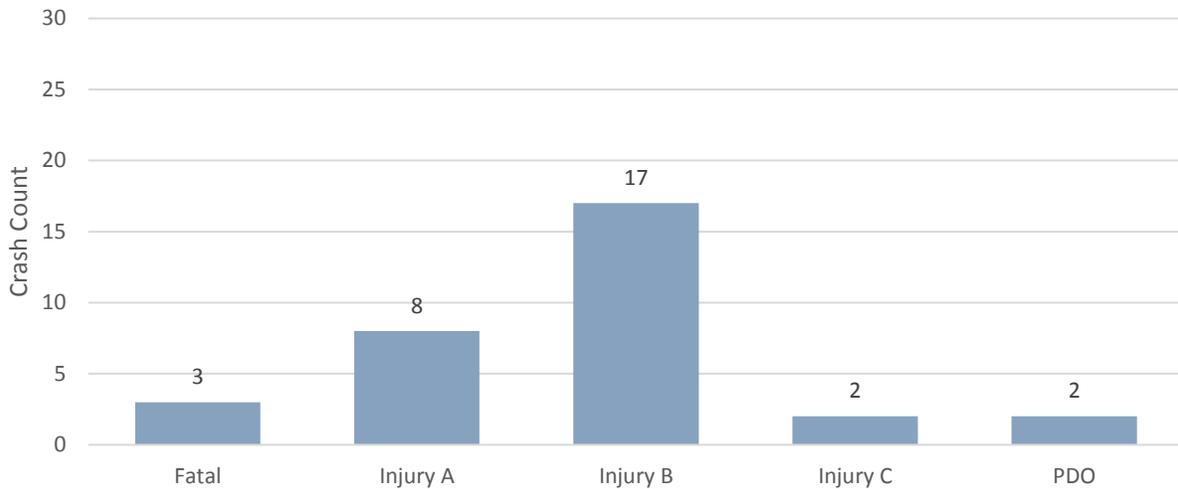
**Figure 38: County Facility Bicyclist Crashes by Severity, Deschutes County (Unincorporated) 2012 – 2016**



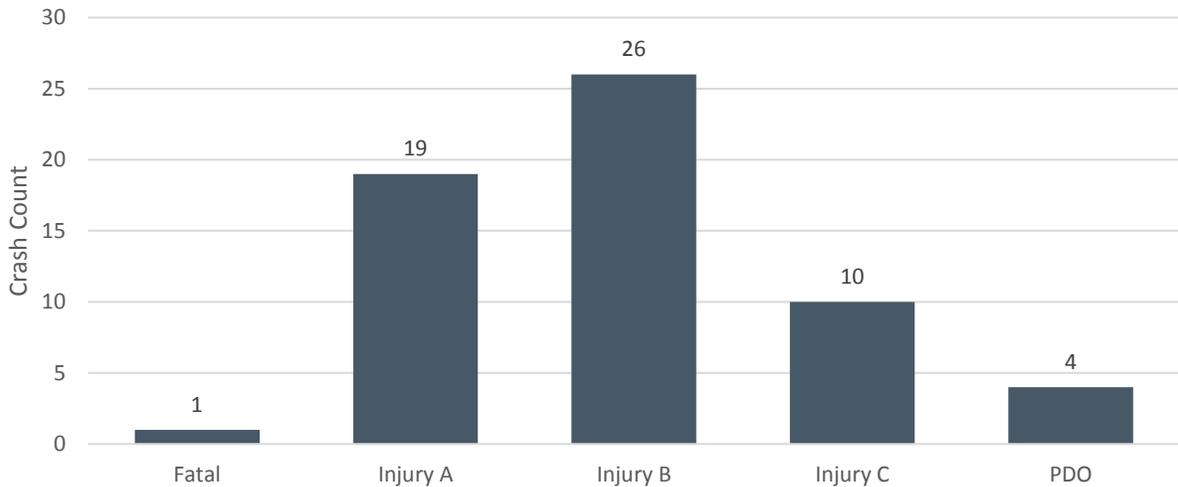
## Motorcycle Crashes

Motorcyclists also represent a vulnerable segment of the road user population. As shown in Figure 39 and Figure 40, 92 crashes were reported in unincorporated Deschutes County involving motorcycles between 2012 and 2016. As shown in the figures, approximately 94 percent of motorcycle crashes on both facility types resulted in some level of injury, and 34 percent of motorcycle-involved crashes on both facility types resulted in fatal or incapacitating injuries. Overall, motorcycle-involved crashes accounted for three percent of unincorporated County crashes between 2012 and 2016 and 18 percent of fatal/incapacitating crashes.

**Figure 39: State Facility Motorcycle Crashes by Severity, Deschutes County (Unincorporated) 2012 – 2016**



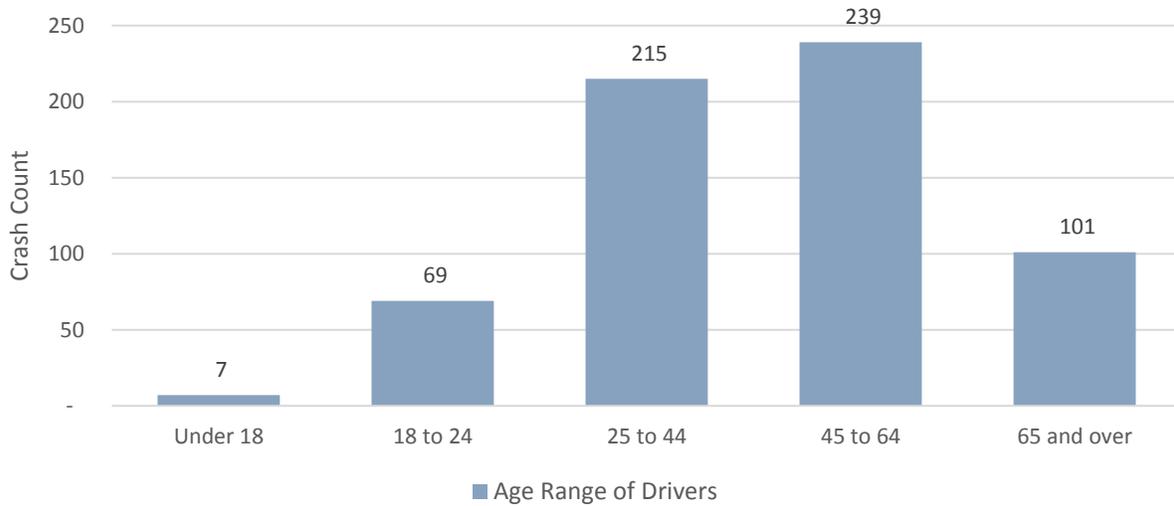
**Figure 40: County Facility Motorcycle Crashes by Severity, Deschutes County (Unincorporated) 2012 – 2016**



## Driver Age

Figure 41 summarizes the distribution of age for drivers involved in crashes in unincorporated Deschutes County. Sixteen percent of reported crashes, and 13 percent of fatal/incapacitating crashes, involve drivers age 65 and older. Fifteen percent of reported crashes, and nine percent of fatal/incapacitating crashes, involve drivers under age 25. Of the 166 crashes involving drivers under age 25, five percent resulted in a fatality or incapacitating injury. Of the 181 crashes involving drivers over age 65, seven percent resulted in fatal or incapacitating injury.

**Figure 41: State Facility Driver Age in Crashes, Deschutes County (Unincorporated) 2012 – 2016**



Note: Driver age was available in crash records for 631 reported crashes in the County (state and county roads). This chart and summary statistics reflect only the crashes with driver age information.

## Driver Residence

Driver residence is listed for each driver involved in a crash. This information is provided at the level of specificity given in Table 6 and Table 7. Among drivers for whom this statistic was reported, the vast majority were within 25 miles of their residence. Crashes on a state highway were more likely to involve drivers who live more than 25 miles from the site, compared to county highways.

**Table 6: State Facility Crashes by Driver Residence, Deschutes County (Unincorporated) Crashes 2012-2016**

Driver Residence	Crash Count	Share Among Drivers
Non-resident	181	9%
Oregon Resident <25 mi of home	1,496	78%
Oregon Resident >25 mi of home	233	12%
Oregon Resident: Unknown Distance	3	0%
<b>Total</b>	<b>1,913</b>	<b>100%</b>

**Table 7: County Facility Crashes by Driver Residence, Deschutes County (Unincorporated) Crashes 2012-2016**

Driver Residence	Crash Count	Share Among Drivers
Non-resident	58	3%
Oregon Resident <25 mi of home	1,696	91%
Oregon Resident >25 mi of home	97	5%
Oregon Resident: Unknown Distance	3	0%
<b>Total</b>	<b>1,854</b>	<b>100%</b>

## SUMMARY OF DESCHUTES COUNTY CRASH ANALYSIS

Based on the crash data analysis, Kittelson identified the following potential emphasis areas, summarized in Table 8, for unincorporated Deschutes County.

**Table 8. Summary of Deschutes County Crash Analysis**

Topic	State Facility	County Facility
Collision Type	33 percent of fatal/incapacitating crashes were roadway departure (fixed object and non-collision/roll-over)	64 percent of fatal/incapacitating crashes were roadway departure (fixed object and non-collision/roll-over)
	34 percent of fatal/incapacitating crashes were head-on or sideswipe, meeting	8 percent of fatal/incapacitating crashes were head-on or sideswipe, meeting
Roadway Characteristics	--	Highest share of overall reported crashes (38 percent) occurred on arterials
	--	Highest share of fatal or incapacitating injury crashes (40 percent) occurred on collectors
	22 percent of fatal/incapacitating crashes occurred on snow or ice	7 percent of fatal/incapacitating crashes occurred on snow/ice
	27 percent of fatality or incapacitating injury crashes occurred at an intersection	38 percent of fatality or incapacitating injury crashes occurred at an intersection
Light Conditions	40 percent of fatal/incapacitating crashes occurred in dark, dawn, or dusk conditions.	27 percent of fatal/incapacitating crashes occurred in dark, dawn, or dusk conditions.
Behavioral Characteristics	22 percent of fatal/incapacitating crashes involved alcohol or drugs	26 percent of fatal/incapacitating crashes involved alcohol or drugs
	43 percent of fatal/incapacitating crashes involved speed	42 percent of fatal/incapacitating crashes involved speed
	20 percent of fatal/incapacitating crashes involved at least one participant not using safety equipment	18 percent of fatal/incapacitating crashes involved at least one participant not using safety equipment
Road Users	Six reported pedestrian crashes including one fatal, one incapacitating injury, three moderate injury, and one minor injury crash.	Four moderate injury pedestrian crashes.
	Five bicycle crashes, including one incapacitating injury, three moderate injury, and one minor injury crashes.	15 bicycle crashes, including four incapacitating injury, nine moderate injury, and two minor injury crashes.
	94 percent of motorcycle crashes resulted in some level of injury; 34 percent of motorcycle crashes resulted in fatal/incapacitating injury.	
	21 percent of crashes involved drivers more than 25 miles from home.	8 percent of crashes involved drivers more than 25 miles from home.

*These potential emphasis areas were identified based on crash data and will be discussed with the County Project Management Team and advisory committees to agree upon emphasis areas. Some emphasis areas may be prioritized over others based on fatal and incapacitating crashes.*

## CITY OF LA PINE

The City of La Pine is a small city located in Deschutes County. This section summarizes the reported crash characteristics within city limits.

According to the Portland State University (PSU) Population Estimates, the City of La Pine grew from approximately 1,660 residents in 2010 to 1,730 residents in 2017, as shown in Figure 42. This growth equates to a total of approximately 4.2 percent growth between 2010 and 2017, or an average of 0.6 percent growth per year.

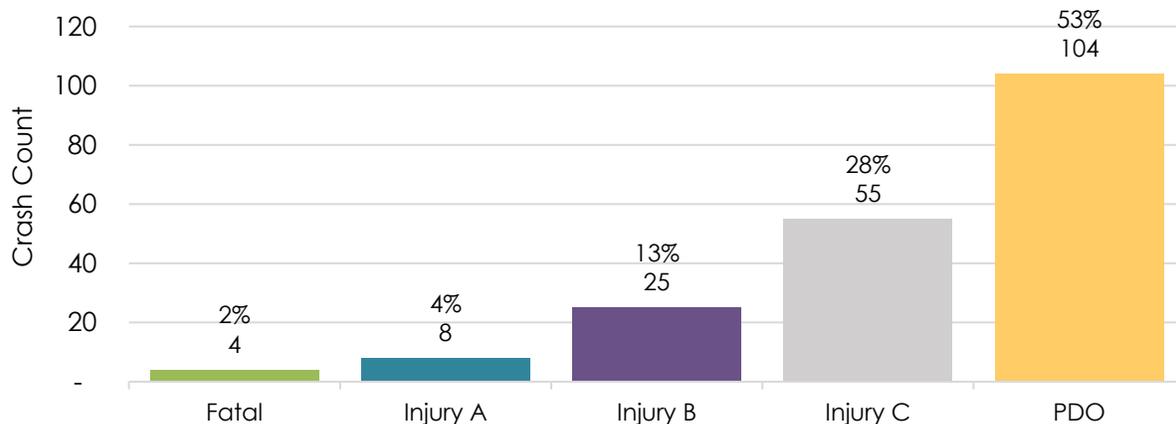
**Figure 42: City of La Pine Population Estimates by Year**

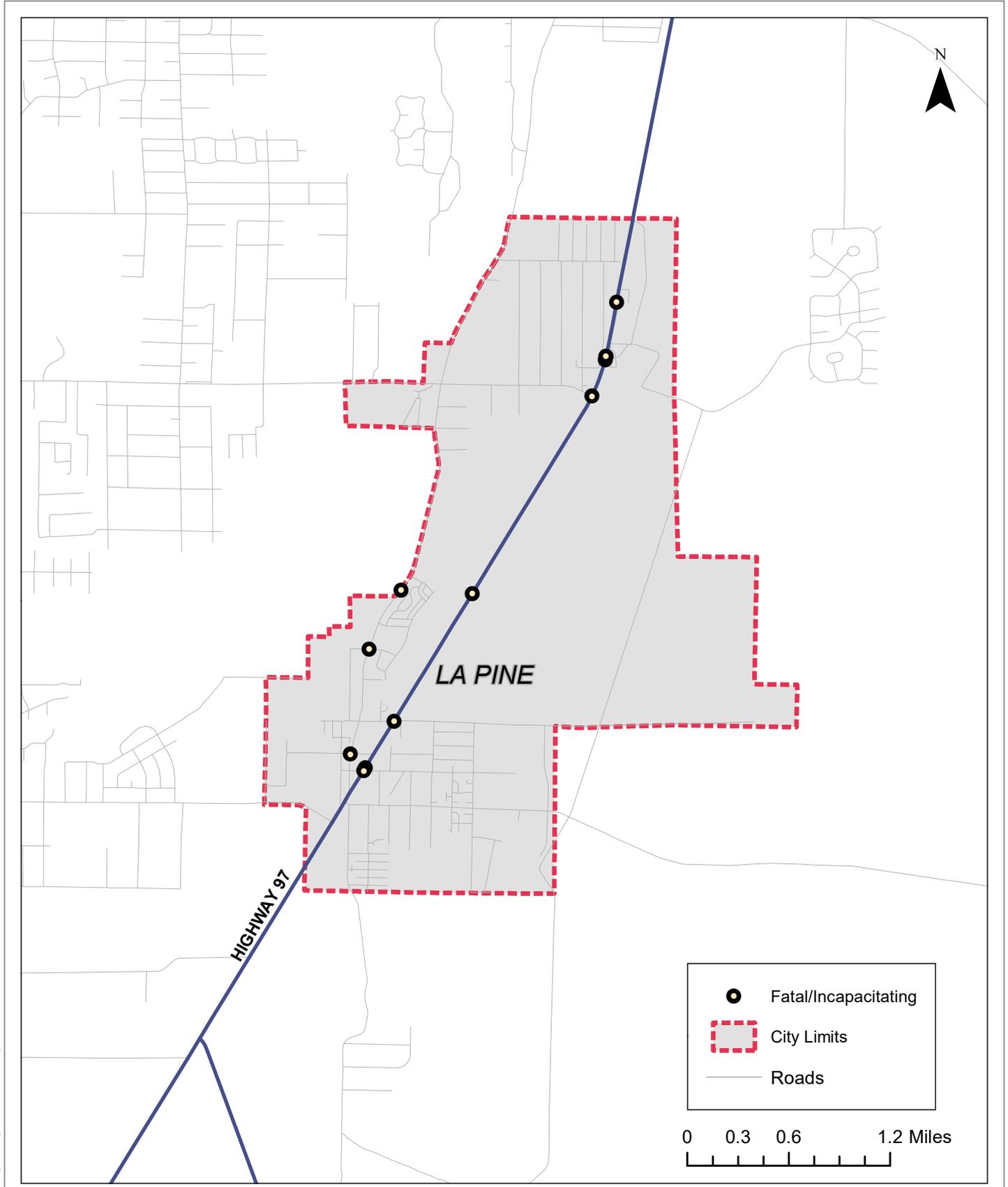


Source: PSU Population Estimates; Kittelson & Associates

Between 2012 and 2016, 177 crashes were reported in La Pine. Of these, 47 percent resulted in some level of injury, and six percent (12 crashes) of reported crashes resulted in a fatality or incapacitating injury, as shown in Figure 43. Figure 44 illustrates the location of the fatal/incapacitating crashes within the City. Fifty-one percent of reported crashes (and 75 percent of fatal/incapacitating crashes) occurred on state highways in La Pine. The remaining fatal/incapacitating crashes occurred on Huntington Road.

**Figure 43: Reported Crashes by Severity, La Pine, 2012-2016**





**Fatal and Incapacitating Injury Crashes  
City of La Pine**

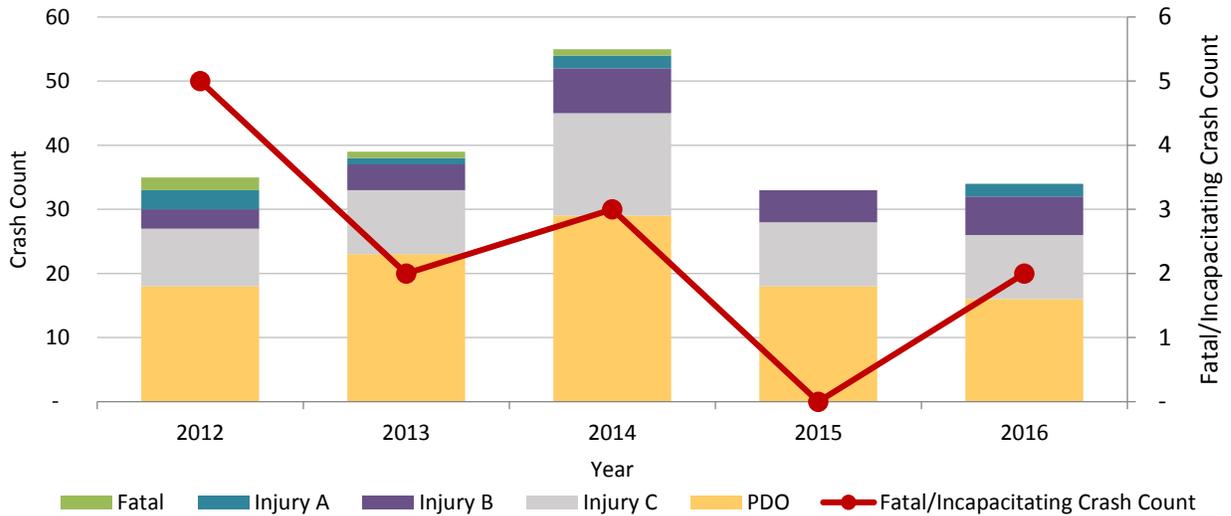
**Figure  
44**

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## CRASH SUMMARY BY YEAR, MONTH, DAY, AND TIME

The number of reported crashes per year has stayed relatively constant in La Pine from 2012 through 2016, with the exception of 2014 when a higher number of crashes was reported, as shown on Figure 45. The percent of crashes that resulted in an injury ranged from 41 percent to 53 percent each year. As shown in the figure, the number of fatal/incapacitating crashes per year varied from zero to five, with the highest number reported in 2012.

**Figure 45: Reported Crashes by Year, La Pine, 2012-2016**



The number of crashes per month is shown in Figure 46. The number of crashes each month varied from nine to 23 crashes and did not show strong seasonal trends. Similarly, the number of fatal/incapacitating crashes per month varied from zero to two crashes.

**Figure 46: Reported Crashes by Month, La Pine, 2012-2016**

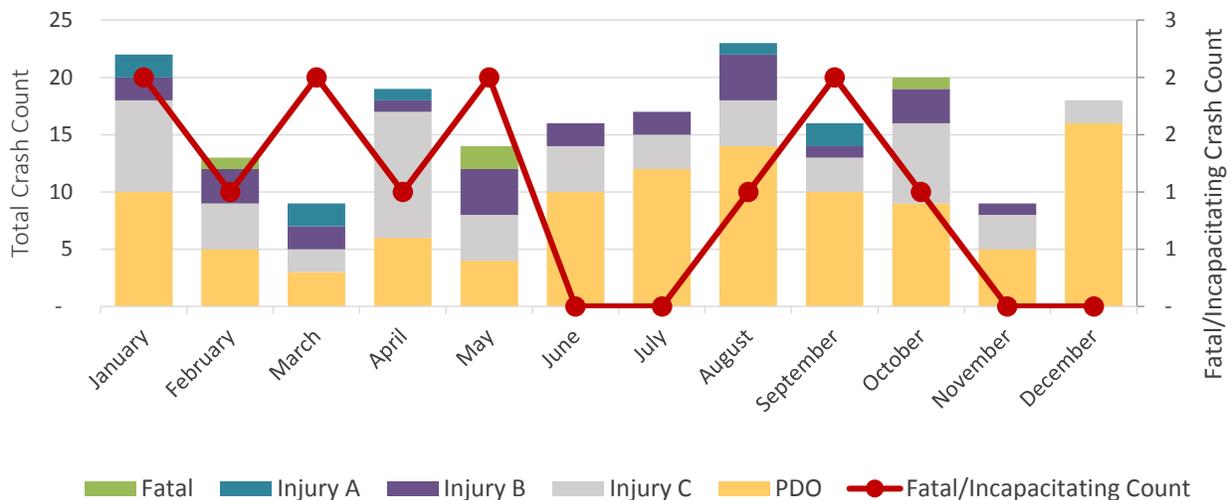


Figure 47 shows the number of reported crashes by day of the week. The number of crashes remains relatively consistent each day, with a slightly decrease on the weekend.

**Figure 47: Reported Crashes by Weekday, La Pine, 2012-2016**

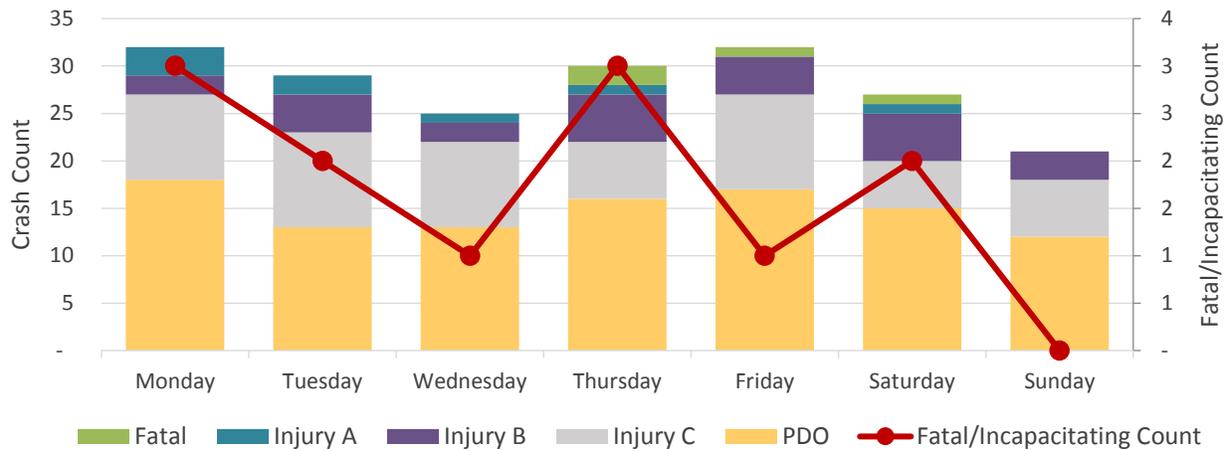
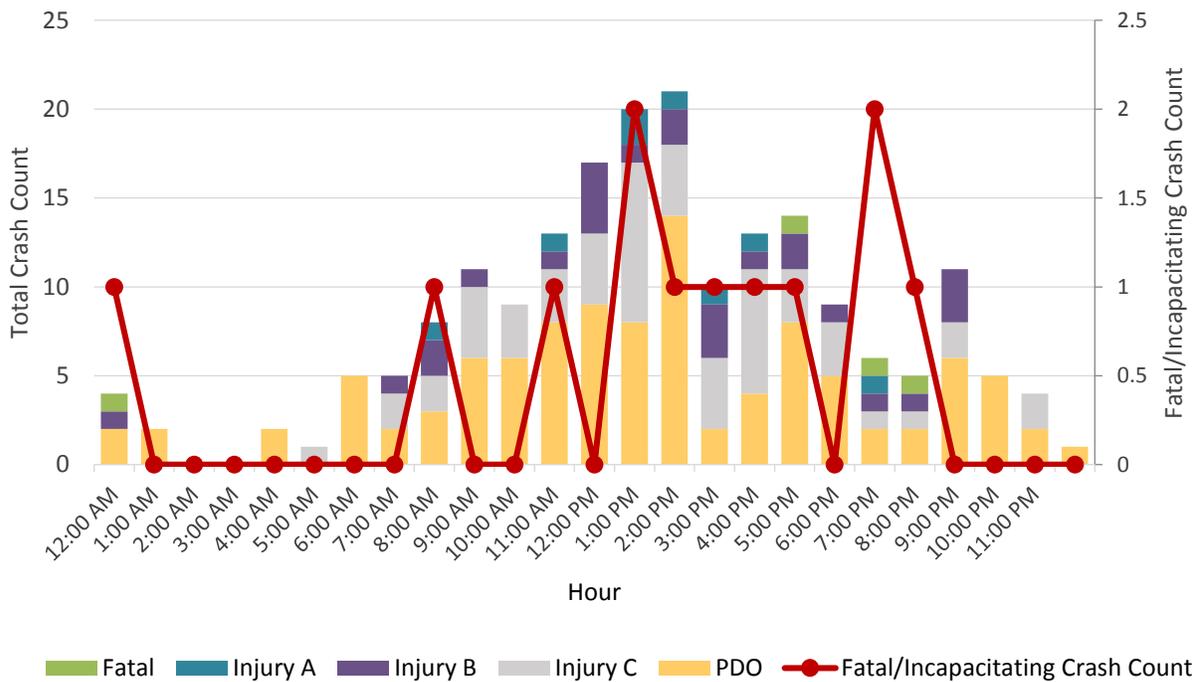


Figure 48 shows the highest number of crashes occurred during midday hours, between 11:00 am and 3:00 pm. Thirty-six percent of reported crashes occurred between these hours. Thirty-three percent of fatal/incapacitating crashes occurred within these hours.

**Figure 48: Reported Crashes by Time of Day, City of La Pine, 2012 – 2016**



## ROADWAY CHARACTERISTICS

### Light Conditions

Reported light conditions for each crash describes the amount of ambient light available at the time of crash. Of the reported crashes, summarized in Table 9, 72 percent occurred in daylight conditions and six percent of those were fatal/incapacitating crashes. Approximately 28 percent of crashes occurred in dark, dawn, or dusk conditions. Similarly, approximately 33 percent (four crashes) of fatal/incapacitating crashes occurred in dark, dawn, or dusk conditions.

Among the crashes that occurred in dark, dawn, or dusk conditions, seven percent resulted in fatal or incapacitating injuries. Among the crashes that occurred in daylight, six percent resulted in fatal or incapacitating injuries.

**Table 9: Reported Crashes by Light Conditions and Severity, La Pine, 2012 – 2016**

Light Conditions	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal & Injury A Total		
Daylight	1	7	18	44	71	141	72%	8	67%
Darkness – no street lights	3	-	4	6	27	40	20%	3	25%
Dusk (Twilight)	-	1	2	1	2	6	3%	1	8%
Darkness – with street lights	-	-	-	1	2	3	2%	-	-
Dawn (Twilight)	-	-	1	3	2	6	3%	-	-
<b>Total</b>	<b>4</b>	<b>8</b>	<b>25</b>	<b>55</b>	<b>104</b>	<b>196</b>	<b>12</b>		

### Roadway Surface Conditions

Table 10 shows that the majority of reported crashes (74 percent) occurred on dry roadway surface conditions. The remaining crashes occurred on ice (11 percent), wet roads (nine percent), snow (three percent), or unknown surface conditions (three percent). One incapacitating crash occurred on wet road conditions; the remaining fatal/incapacitating crashes occurred on dry roadways.

Among the 145 crashes that occurred on dry roadways, 50 percent resulted in some level of injury. Among the 17 crashes that occurred on wet roads, 59 percent resulted in some level of injury. Among the 28 crashes that occurred on snow or ice, 32 percent resulted in some level of injury.

**Table 10: Reported Crashes by Roadway Conditions and Severity, La Pine, 2012 – 2016**

Road Conditions	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal & Injury A Total		
Dry	4	7	20	41	73	145	74%	11	92%
Ice	-	-	1	6	15	22	11%	-	0%
Wet	-	1	4	5	7	17	9%	1	8%
Snow	-	-	-	2	4	6	3%	-	0%
Unknown	-	-	-	1	5	6	3%	-	0%
<b>Total</b>	<b>4</b>	<b>8</b>	<b>25</b>	<b>55</b>	<b>104</b>	<b>196</b>	<b>12</b>		

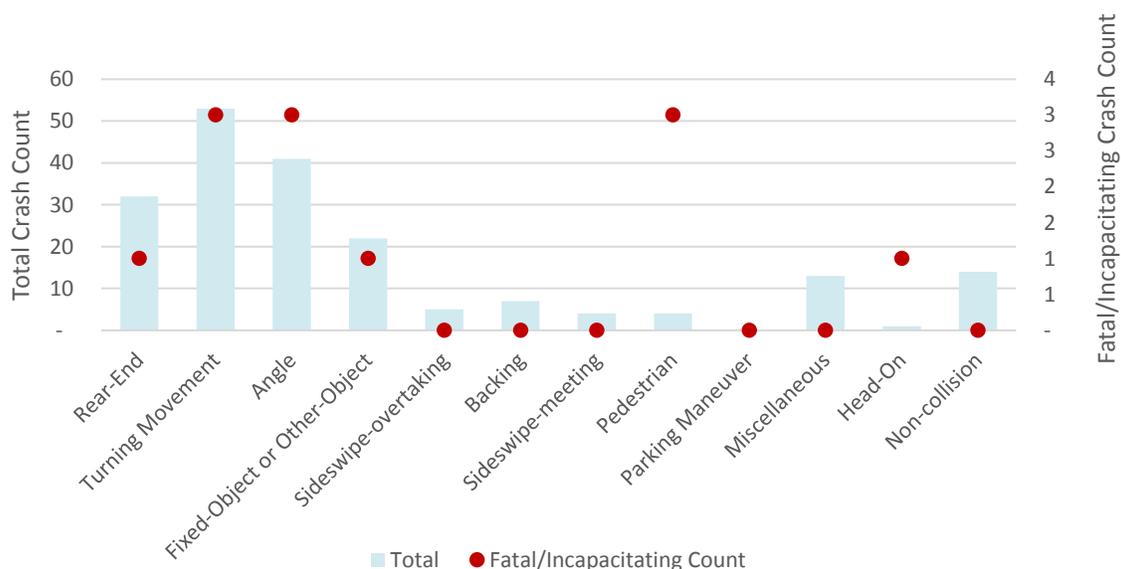
## COLLISION TYPE AND CONTRIBUTING FACTORS

### Collision Type

The most common collision type among reported crashes in La Pine was *turning movement* crashes (27 percent), *angle* crashes (21 percent), and *rear-end* crashes (16 percent), as shown in Figure 49. Among the 12 fatal/incapacitating crashes, the most common collision types were *turning movement* (three crashes, 25 percent), *angle* (three crashes, 25 percent), and *pedestrian* crashes (three crashes, 25 percent).

Although *pedestrian* crashes account for two percent of overall reported crashes, three of the four *pedestrian* crashes resulted in a fatality. In addition, the single reported *head-on* collision resulted in a fatality. The remaining fatal/incapacitating crashes included one *fixed-object* crash and one *rear-end* crash.

Figure 49: Reported Crashes by Collision Type, La Pine, 2012 – 2016



The statewide Oregon TSAP identifies intersection crashes and roadway departure crashes as emphasis areas for the state.

*Turning movement*, *angle*, and some *rear-end* crashes are typically associated with intersections. These three crash types account for 64 percent of reported crashes in La Pine and 58 percent fatal/incapacitating crashes in La Pine. Of the 126 reported *rear-end*, *turning movement*, and *angle* crashes in La Pine, six percent resulted in fatality or incapacitating injury.

Roadway departure crashes, or lane departure crashes, include those in which vehicles leave their travel lane: *fixed object or other object*, *head-on*, *sideswipe*, and *non-collision (rollover)*. These roadway departure crash types account for 23 percent of reported crashes in La Pine and 16 percent (two crashes) of fatal/incapacitating crashes. Of the 46 reported *fixed object*, *head-on*, *sideswipe*, and *non-collision (rollover)* crashes in La Pine, four percent (two crashes) resulted in fatality or incapacitating injury.

### Contributing Factors

The three most common reported contributing factors included *did not yield right-of-way* (33 percent), *speed too fast for conditions (not exceeding limit)* (10 percent), and *followed too closely* (nine percent).

When considering only fatal/incapacitating crashes, *did not yield right-of-way* (28 percent, or five crashes), *non-motorist illegally in roadway* (17 percent), and *non-motorist clothing not visible* (17 percent, or three crashes) accounted for the top three contributing factors.

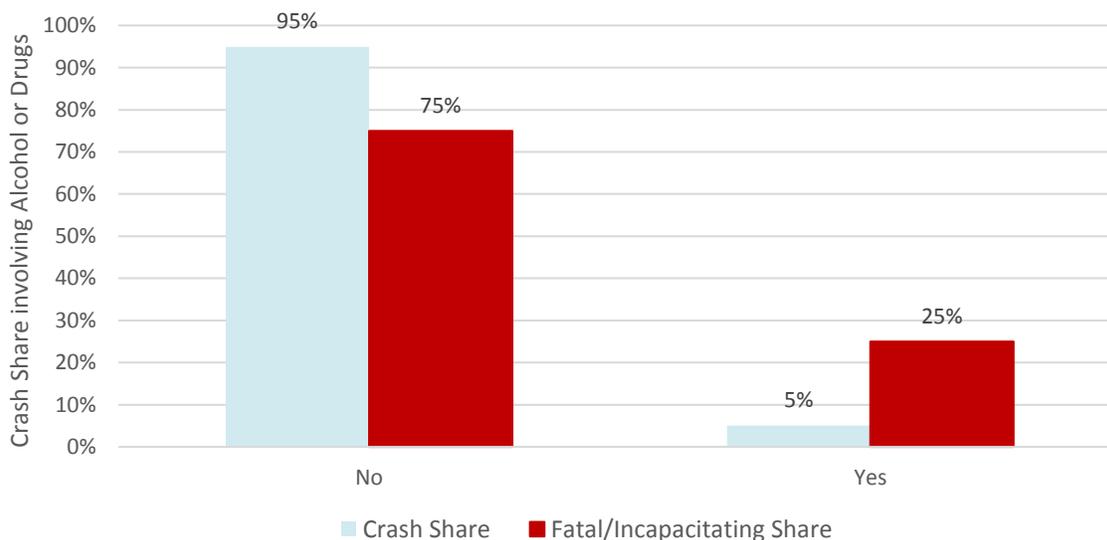
## BEHAVIORAL CHARACTERISTICS

### Alcohol/Drugs Involved

The influence of alcohol and drug use in reported crashes is coded in the crash data from the officer's assessment. In the case of drug use, a crash would be flagged if drug use is reported by the police, by test results, or if the suspect admits use. A flag in the data for alcohol use would occur from observations at the scene, breath or field sobriety tests, or conclusions in the reporting officer's narrative. The two flags are combined for summary here. As seen in Figure 50, five percent of reported crashes involved alcohol or drugs, and 25 percent of fatal/incapacitating crashes involved alcohol or drugs.

Alcohol/drug involved crashes were more likely to result in injury than those that do not involve alcohol or drugs. Thirty percent of alcohol/drug involved crashes resulted in fatal or incapacitating injuries, compared to five percent of crashes not involving alcohol or drugs.

Figure 50: Reported Crash Share involving Alcohol or Drugs, La Pine, 2012-2016



### Speeding

Speeding is captured in two separate contributing factors as discussed above (exceeding the posted speed limit and traveling too fast for conditions). ODOT summarizes this data in an "excessive speeding" flag to identify crashes associated with speed as a factor. As shown in Table 11, excessive speeds were flagged in approximately 13 percent of all crashes. The fatal/incapacitating share is slightly lower, with eight percent of crashes involving excessive speeds. Of the crashes that involved excessive speed, 54 percent resulted in some level of injury, and four percent resulted in fatal or incapacitating injury. In comparison, 46 percent of crashes that did not involve excessive speed resulted in some level of injury, and six percent of non-speed related crashes resulted in fatal or incapacitating injury. This indicates that speed-related crashes were more likely to result in injury but not a fatal/incapacitating injury.

**Table 11: Excessive Speeding Crashes, La Pine, 2012 – 2016**

Excessive Speed Flag	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal & Injury A Total
No	4	7	19	48	92	170 (87%)	11 (92%)
Yes	0	1	6	7	12	26 (13%)	1 (8%)
<b>Total</b>	<b>4</b>	<b>8</b>	<b>25</b>	<b>55</b>	<b>104</b>	<b>196</b>	<b>12</b>

## Safety Equipment Use

Crash data indicates the number of participants in a crash who used and did not use safety equipment. Safety equipment includes a variety of items including seat belts, child seats, booster seats, and bike helmets. Based on this data, shown in Table 12, eight percent of fatal/incapacitating crashes involved at least one participant who was not using safety equipment. Of the crashes that involved participant(s) not using safety equipment, 80 percent resulted in injury and 20 percent resulted in fatal/incapacitating injuries. In comparison, 46 percent of crashes in which all participants used safety equipment resulted in some level of injury and six percent resulted in fatal or incapacitating injury.

**Table 12: Safety Equipment Usage, La Pine, Crashes 2012-2016**

	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal & Injury A Total
Safety equipment used by all participants	3	8	23	54	103	191 (97%)	11 (92%)
Safety equipment not used by at least one participant	1	0	2	1	1	5 (3%)	1 (8%)
<b>Total</b>	<b>4</b>	<b>8</b>	<b>25</b>	<b>55</b>	<b>104</b>	<b>196</b>	<b>12</b>

## VULNERABLE ROAD USERS

### Pedestrians

As noted in the collision type discussion, pedestrian crashes constitute a relatively low share of overall crashes in La Pine, with four reported pedestrian collisions. Pedestrian crashes accounted for less than one percent of crashes in La Pine. However, when pedestrians are involved in crashes, the results are more likely to be severe than in crashes involving only vehicles. The four reported pedestrian crashes in La Pine all resulted in some level of injury between 2012 and 2016. Three of these reported crashes (75 percent) resulted in fatality, and one crash resulted in a minor injury. Pedestrian crashes accounted for 33 percent of the total fatal/incapacitating crashes in La Pine.

Reported contributing factors indicated that *non-motorist clothing not visible* was reported in the four pedestrian crashes, and three of the pedestrian crashes also indicated that the *non-motorist was illegally in the roadway*.

### Bicyclists

Bicyclist crashes also constitute a relatively low share of total crashes but are more likely to result in injury when they occur. Between 2012 and 2016, three bicycle crashes were reported in La Pine. One crash resulted in a moderate injury, and two crashes resulted in minor injuries.

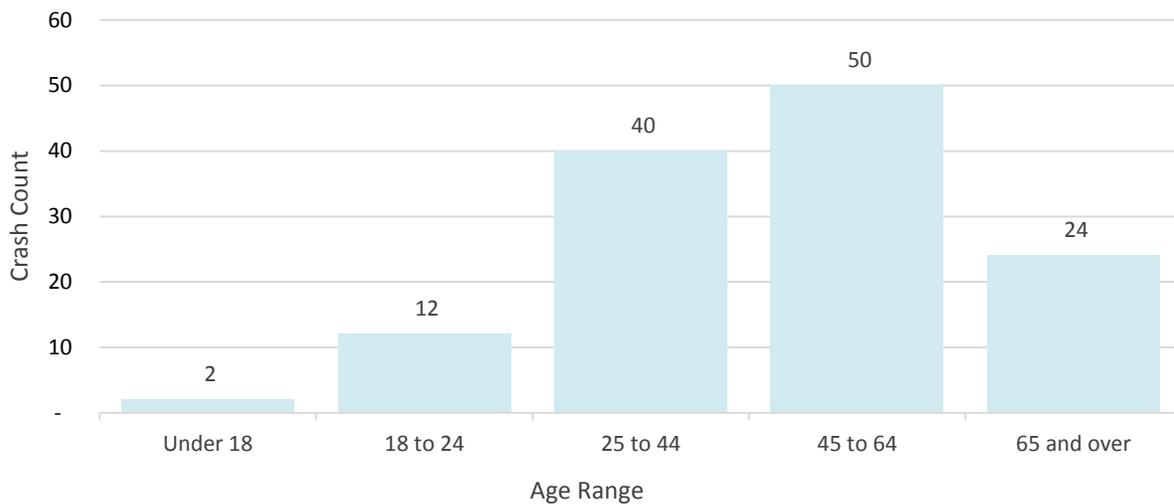
## Motorcycles

Between 2012 and 2016, two reported crashes in La Pine involved motorcycles. Both motorcycle-involved crashes resulted in injury: one crash resulted in minor injury, and one crash resulted in moderate injury.

## Driver Age

Figure 51 summarizes the distribution of age for drivers involved in crashes in La Pine. Nineteen percent (24 crashes) of reported crashes, and 50 percent (four crashes) of fatal/incapacitating crashes, involve drivers age 65 and older. Eleven percent (14 crashes) of reported crashes involve drivers under age 25; no fatal/incapacitating crashes were reported with drivers under the age of 25. Of the 24 crashes involving drivers over age 65, 33 percent resulted in fatal or incapacitating injury.

Figure 51: Driver Age in Crashes, La Pine, 2012 – 2016



Note: Driver age was available in crash records for 128 reported crashes, including eight fatal/incapacitating crashes. This chart and summary statistics reflect only the crashes with driver age information.

## SUMMARY OF LA PINE CRASH ANALYSIS

Based on the crash data analysis, Kittelson identified the following potential emphasis areas for La Pine (bold text indicates emphasis areas that align with Oregon statewide emphasis areas):

### ► Intersection related crashes

- *Turning movement, angle, and rear-end* crashes accounted for 64 percent of reported crashes in La Pine and 58 percent of fatal/incapacitating crashes in La Pine.

### ► Pedestrian crashes

- Three of the four pedestrian crashes resulted in fatalities.

### ► Alcohol/drugs involved

- Alcohol or drugs were involved in 25 percent of fatal/incapacitating crashes.
- 30 percent of alcohol/drug involved crashes resulted in fatal/incapacitating injuries.

### ► Crashes on US 97

- Over half of fatal/incapacitating crashes occurred on US 97.

### ► Dark, dawn, or dusk conditions

- 33 percent (four crashes) of fatal/incapacitating crashes occurred in dark, dawn, or dusk conditions.
- ▶ **Bicycle crashes**
  - The three bicycle crashes resulted in minor or moderate injuries.
- ▶ **Motorcycle crashes**
  - Both motorcycle crashes resulted in minor to moderate injuries.
- ▶ **Roadway departure crashes**
  - Roadway departure crashes account for 23 percent of reported crashes in La Pine and 16 percent (two crashes) of fatal/incapacitating crashes.
- ▶ **Excessive speed involved**
  - 13 percent of reported crashes in La Pine involved excessive speed.
  - 54 percent of crashes involving excessive speed resulted in some level of injury.
- ▶ **Drivers over age 65**
  - 19 percent (24 crashes) of reported crashes involve drivers age 65 and over.
  - Two fatal/incapacitating crashes involve drivers age 65 and over.

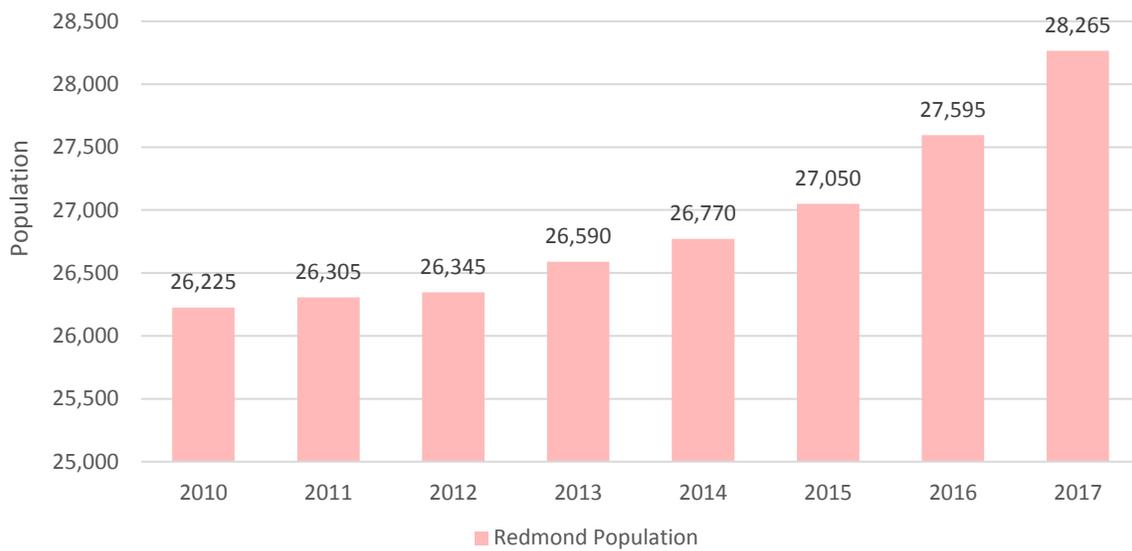
*These potential emphasis areas were identified based on crash data and will be discussed with the County Project Management Team and advisory committees to agree upon emphasis areas. Some emphasis areas may be prioritized over others based on fatal and incapacitating crashes.*

## CITY OF REDMOND

The City of Redmond is located in Deschutes County, approximately ten miles north of Bend. This section summarizes the reported crashes and crash characteristics within city limits.

According to the Portland State University (PSU) Population Estimates, the City of Redmond grew from approximately 26,225 residents in 2010 to 28,265 residents in 2017, as shown in Figure 52. This growth equates to a total of approximately 7.8 percent growth between 2010 and 2017, or an average of 1.1 percent growth per year.

**Figure 52: City of Redmond Population Estimates by Year**

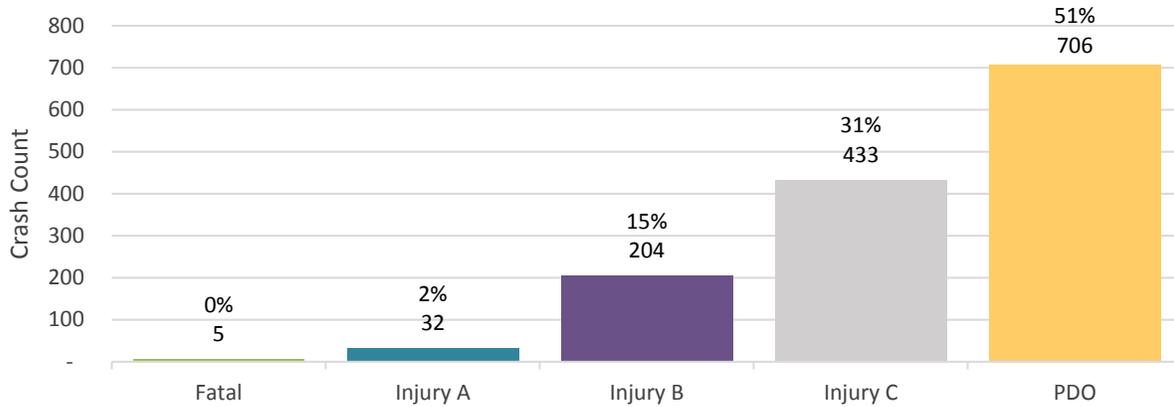


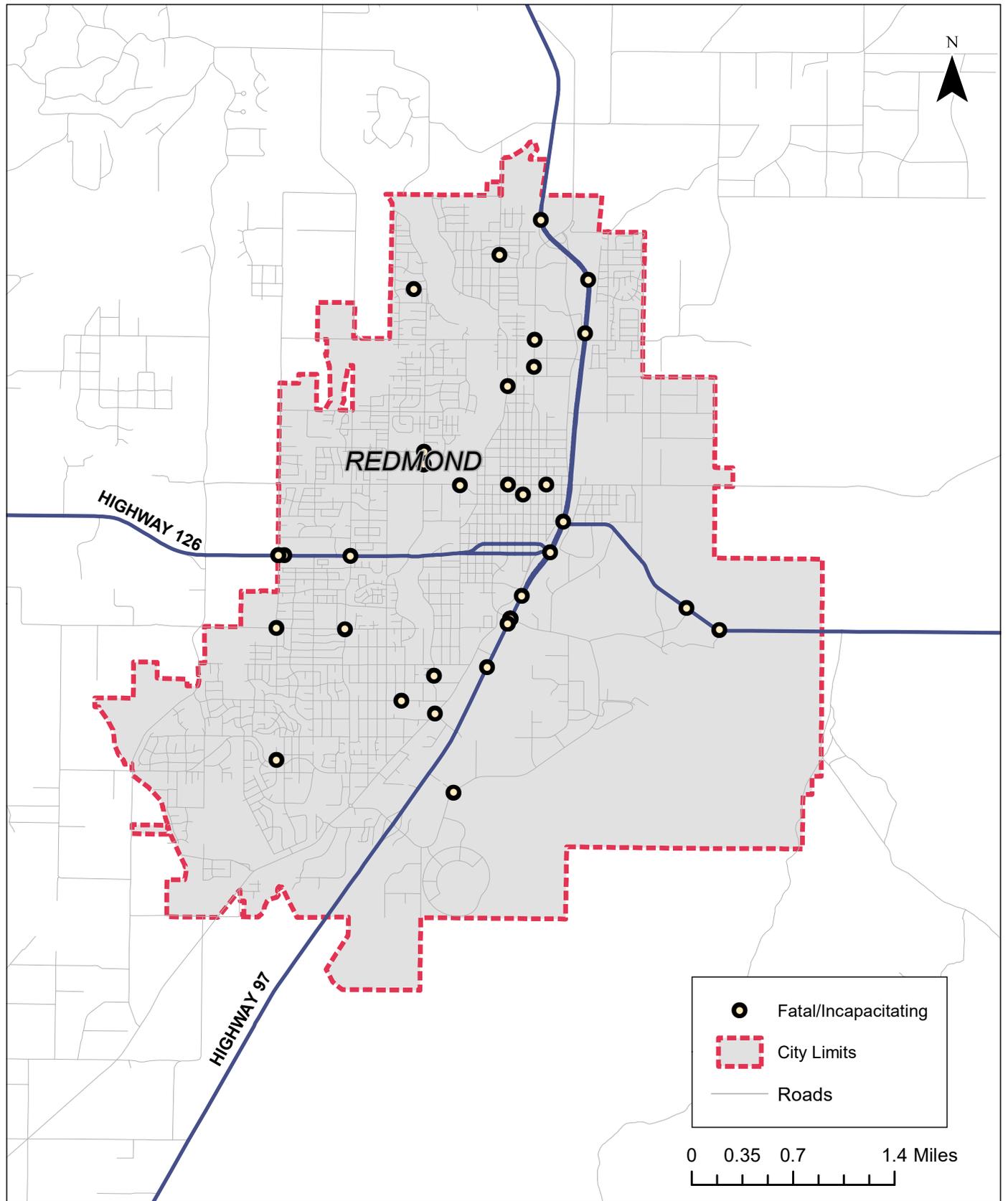
Source: PSU Population Estimates; Kittelson & Associates

Between 2012 and 2016, 1,380 crashes were reported in Redmond. Of these, 49 percent resulted in some level of injury, and two percent (37 crashes) of reported crashes resulted in fatal or incapacitating injury, as shown in Figure 53.

Figure 54 illustrates the location of the fatal/incapacitating crashes within the City. Forty-six percent of reported crashes (and 51 percent of fatal/incapacitating crashes) occurred on state highways in Redmond. As shown on the figure, many of the fatal/incapacitating crashes were located on key north-south and east-west routes throughout the City, including US 97 and OR 126, as well as City streets.

**Figure 53: Reported Crashes by Severity, La Pine, 2012-2016**





**Fatal and Incapacitating Injury Crashes  
City of Redmond**

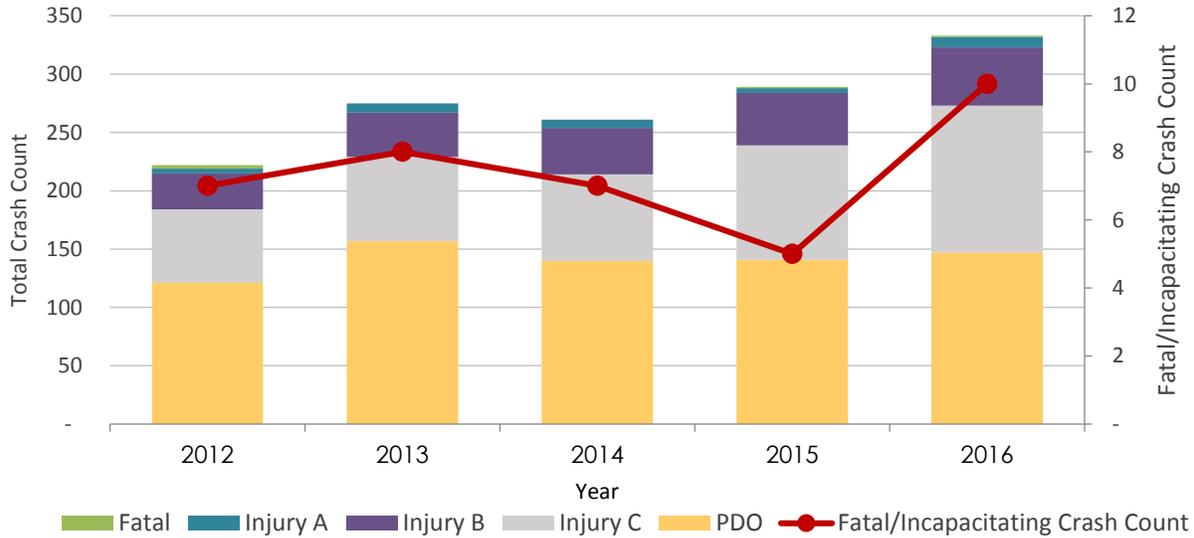
**Figure  
54**

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## CRASH SUMMARY BY YEAR, MONTH, DAY, AND TIME

The number of reported crashes per year has generally shown an increasing trend in Redmond from 2012 through 2016, as shown on Figure 55. The percent of crashes that resulted in an injury ranged from 43 percent to 56 percent each year. As shown in the figure, the number of fatal/incapacitating crashes per year varied from five to ten, with the highest number reported in 2016.

Figure 55: Reported Crashes by Year, Redmond 2012-2016



The number of crashes per month is shown in Figure 56. The number of crashes each month varied from 88 to 161 crashes, with the highest crash frequency occurring in December. The number of fatal/incapacitating crashes varied from one to seven per month and did not show strong seasonal trends.

Figure 56: Reported Crashes by Month, Redmond, 2012-2016

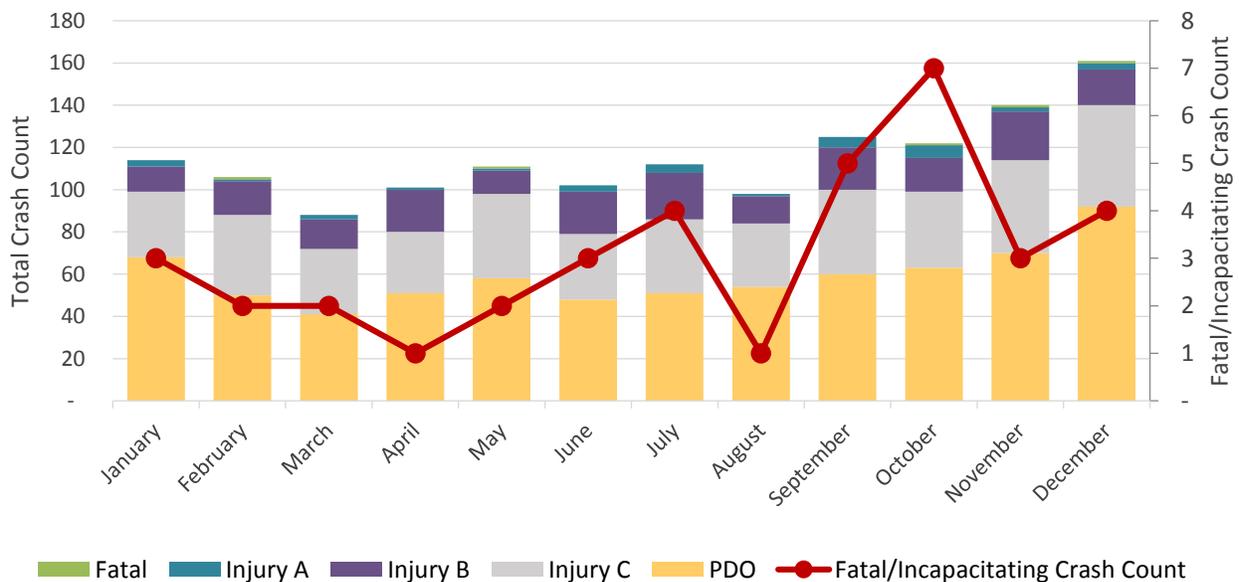


Figure 57 shows the reported crashes by day of the week. The total number of crashes remained relatively consistent each day, with a slight increase on Friday and a sharper decrease on the weekend. The number of fatal/incapacitating crashes remained relatively constant, hovering between four and five crashes per day, with the exception of Mondays, when ten fatal/incapacitating crashes were reported.

**Figure 57: Reported Crashes by Weekday, Redmond, 2012-2016**

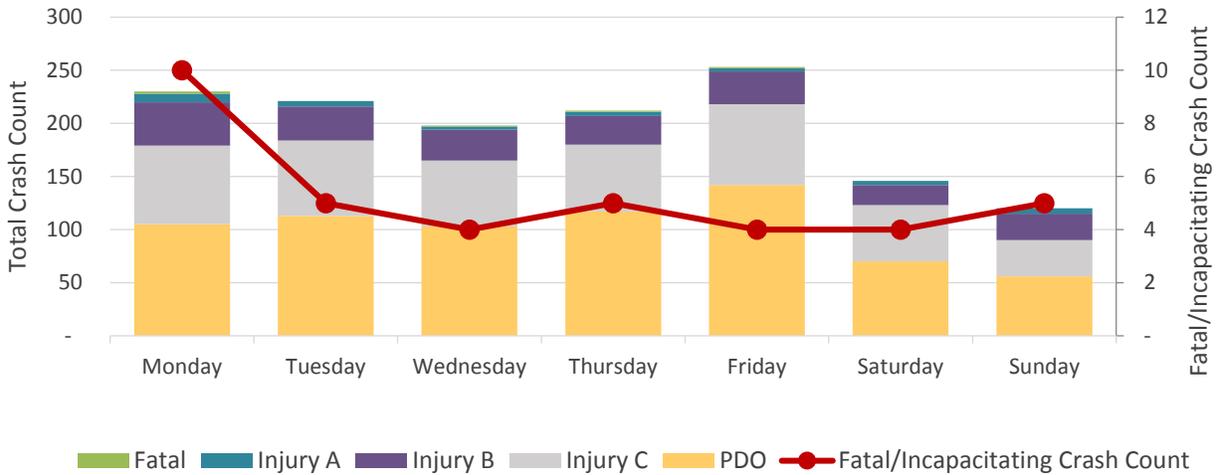
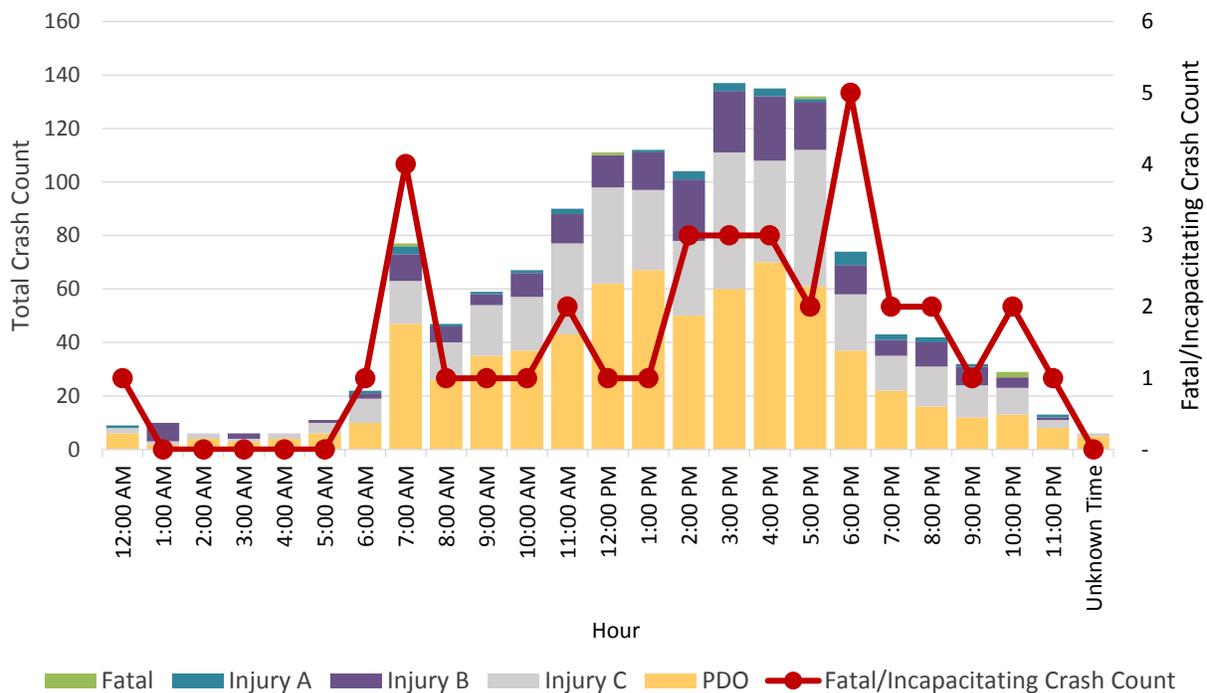


Figure 58 shows the highest number of crashes occurred during afternoon/early evening hours, between 3:00 pm and 6:00 pm. Thirty percent of reported crashes occurred between these hours. Fatal/incapacitating crashes peaked slightly later, between 6:00 and 7:00 pm. Five fatal/incapacitating crashes (14 percent) occurred during this hour.

**Figure 58: Reported Crashes by Time of Day, Redmond, 2012 – 2016**



## ROADWAY CHARACTERISTICS

### Light Conditions

Reported light conditions for each crash describes the amount of ambient light available at the time of crash. Of the reported crashes, summarized in Table 13, 76 percent occurred in daylight conditions. Approximately 24 percent of crashes occurred in dark, dawn, or dusk conditions. Approximately 43 percent (16 crashes) of fatal/incapacitating crashes occurred in dark, dawn, or dusk conditions.

Among the crashes that occurred in dark, dawn, or dusk conditions, five percent resulted in fatal or incapacitating injuries. Among the crashes that occurred in daylight, two percent resulted in fatal or incapacitating injuries.

**Table 13: Reported Crashes by Light Conditions and Severity, Redmond, 2012 – 2016**

Light Conditions	Fatal	Injury A	Injury B	Injury C	PDO	Total		Fatal & Injury A Total	
Daylight	1	20	150	327	554	1,052	76%	21	57%
Darkness – no street lights	2	5	31	52	79	169	12%	7	19%
Dusk (Twilight)	-	2	8	28	34	72	5%	2	5%
Darkness – with street lights	1	3	12	17	28	61	4%	4	11%
Dawn (Twilight)	1	2	3	9	9	24	2%	3	8%
<b>Total</b>	<b>5</b>	<b>32</b>	<b>204</b>	<b>433</b>	<b>706</b>	<b>1,380</b>		<b>37</b>	

### Roadway Surface Conditions

Table 14 shows that the majority of reported crashes (81 percent) occurred on dry roadway surface conditions. The remaining crashes occurred on ice (nine percent), wet roads (six percent), snow (three percent), or unknown surface conditions (two percent). Four fatal/incapacitating crashes (11 percent) occurred on wet road conditions, and two fatal/incapacitating crashes (five percent) occurred on ice. The remaining 31 fatal/incapacitating crashes (84 percent) occurred on dry roadways.

Among the 1,117 crashes that occurred on dry roadways, 52 percent resulted in some level of injury, and three percent resulted in fatal/incapacitating injuries. Among the 76 crashes that occurred on wet roads, 47 percent resulted in some level of injury, and five percent resulted in fatal/incapacitating injuries. Among the 164 crashes that occurred on snow or ice, 34 percent resulted in some level of injury, and one percent resulted in fatal/incapacitating injuries.

**Table 14: Reported Crashes by Roadway Conditions and Severity Redmond, 2012 – 2016**

Road Conditions	Fatal	Injury A	Injury B	Injury C	PDO	Total		Fatal & Injury A Total	
Dry	3	28	181	366	539	1,117	81%	31	84%
Ice	1	1	5	36	82	125	9%	2	5%
Wet	1	3	15	17	40	76	6%	4	11%
Snow	-	-	3	10	26	39	3%	-	0%
Unknown	-	-	-	4	19	23	2%	-	0%
<b>Total</b>	<b>5</b>	<b>32</b>	<b>204</b>	<b>433</b>	<b>706</b>	<b>1,380</b>		<b>37</b>	

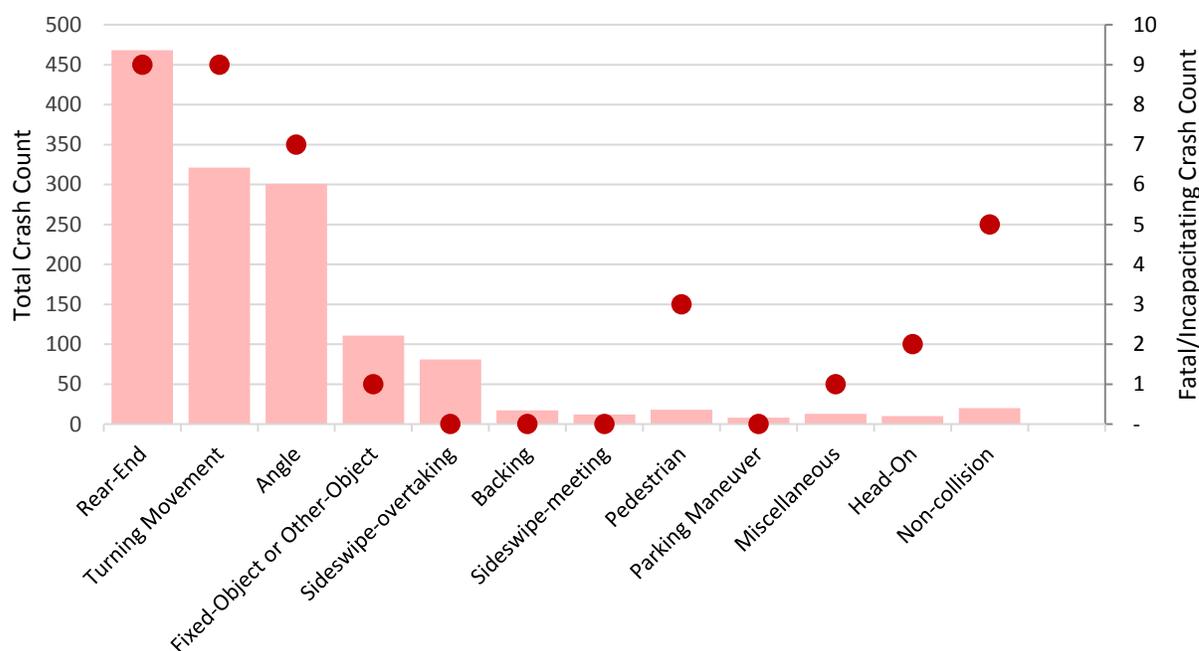
## CRASH TYPE AND CONTRIBUTING FACTORS

### Collision Type

The most common collision types among reported crashes in Redmond were *rear-end* crashes (34 percent), *turning movement* crashes (23 percent), and *angle* crashes (22 percent), as shown in Figure 59. Among the 37 fatal/incapacitating crashes, the most common collision types were *rear-end* (nine crashes, 24 percent), *turning movement* (nine crashes, 24 percent), *angle* (seven crashes, 19 percent), *non-collision* (rollover) crashes (five crashes, 14 percent), and *pedestrian* crashes (three crashes, eight percent).

Although *pedestrian*, *head-on*, and *non-collision* crashes accounted for a relatively low percentage of overall reported crashes, these three crash types were most likely to result in injury when they occurred and therefore accounted for a higher percentage of fatal/incapacitating crashes. Of the 18 reported pedestrian crashes, one hundred percent resulted in an injury of some level, and three crashes (17 percent) resulted in fatal or incapacitating injury. Of the 10 reported *head-on* collisions, 70 percent resulted in an injury, and 20 percent resulted in a fatal or incapacitating injury. Of the 20 *non-collisions* reported, 65 percent resulted in an injury, and 25 percent resulted in an incapacitating injury.

Figure 59: Reported Crashes by Collision Type, Redmond, 2012 – 2016



The statewide Oregon TSAP identifies intersection crashes and roadway departure crashes as emphasis areas for the state.

*Turning movement*, *angle*, and some *rear-end* crashes are typically associated with intersections. These three crash types account for 79 percent of reported crashes in Redmond and 68 percent fatal/incapacitating crashes in Redmond. Of the 1,090 reported *rear-end*, *turning movement*, and *angle* crashes in Redmond, two percent resulted in fatality or incapacitating injury.

Roadway departure crashes, or lane departure crashes, include those in which vehicles leave their travel lane: *fixed object or other object*, *head-on*, *sideswipe*, and *non-collision* (rollover). These roadway departure

crash types account for 17 percent of reported crashes in Redmond and 22 percent of fatal/incapacitating crashes. Of the 234 reported *fixed object, head-on, sideswipe, and non-collision (rollover)* crashes in Redmond, three percent resulted in fatality or incapacitating injury.

## Contributing Factors

The most common reported contributing factors included *did not yield right-of-way* (23 percent), *followed too closely* (17 percent), *disregarded traffic signal* (10 percent), *speed too fast for conditions (not exceeding limit)* (nine percent) and *inattention* (nine percent).

When considering only fatal/incapacitating crashes, *did not yield right-of-way* (19 percent, or nine crashes), *careless driving* (11 percent, or five crashes), *speed too fast for conditions* (nine percent, or four crashes), and *disregarded traffic signal* (nine percent, or four crashes) were the most common contributing factors.

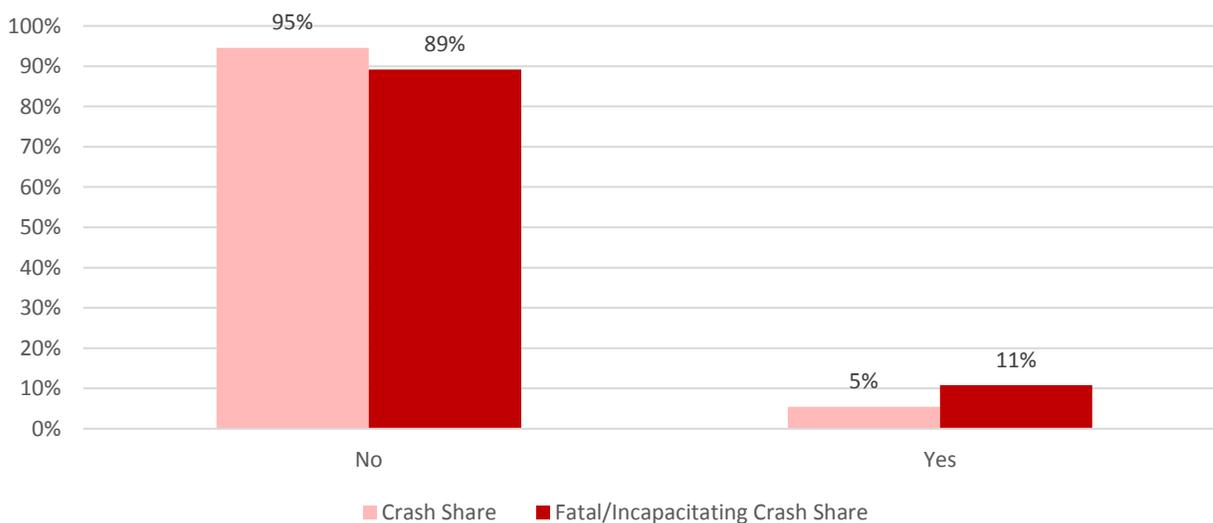
## BEHAVIORAL CHARACTERISTICS

### Alcohol/Drugs Involved

The influence of alcohol and drug use in reported crashes is coded in the crash data from the officer's assessment. In the case of drug use, a crash would be flagged if drug use is reported by the police, by test results, or if the suspect admits use. A flag in the data for alcohol use would occur from observations at the scene, breath or field sobriety tests, or conclusions in the reporting officer's narrative. The two flags are combined for summary here. As seen in Figure 60, five percent of reported crashes involved alcohol or drugs, while 11 percent of fatal/incapacitating crashes involved alcohol or drugs.

Alcohol/drug involved crashes are slightly more likely to result in fatal/incapacitating injury than those that do not involve alcohol/drug use. Five percent of alcohol/drug involved crashes resulted in fatal or incapacitating injuries, compared to three percent of crashes not involving alcohol or drugs.

Figure 60: Reported Crash Share involving Alcohol or Drugs, Redmond, 2012-2016



## Speeding

Speeding is captured in two separate contributing factors as discussed above (exceeding the posted speed limit and traveling too fast for conditions). ODOT summarizes this data in an “excessive speeding” flag to identify crashes associated with speed as a factor. As shown in Table 15, excessive speeds were flagged in approximately 13 percent of all crashes. The fatal/incapacitating share was higher, with 27 percent of crashes involving excessive speeds. Of the crashes that involved excessive speed, 46 percent resulted in some level of injury, and six percent resulted in fatal or incapacitating injury. In comparison, 49 percent of crashes that did not involve excessive speed resulted in some level of injury, and two percent of non-speed related crashes resulted in fatal or incapacitating injury. This indicated that speed related crashes were not more likely to result in injury compared to non-speed involved crashes but were slightly more likely to result in fatal/incapacitating injury.

**Table 15: Excessive Speeding Crashes, Redmond, 2012 – 2016**

Excessive Speed Flag	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal & Injury A Total
No	4	23	183	384	613	1,207 (87%)	27 (73 %)
Yes	1	9	21	49	93	173 (13%)	10 (27 %)
<b>Total</b>	<b>5</b>	<b>32</b>	<b>204</b>	<b>433</b>	<b>706</b>	<b>1,380</b>	<b>37</b>

## Safety Equipment Use

Crash data indicates the number of participants in a crash who used and did not use safety equipment. Safety equipment includes a variety of items including seat belts, child seats, booster seats, and bike helmets. Based on this data, shown in Table 16, eight percent of fatal/incapacitating crashes involved at least one participant who was not using safety equipment. Of the crashes that involved participant(s) not using safety equipment, 70 percent resulted in injury, and 11 percent resulted in fatal/incapacitating injuries. In comparison, 48 percent of crashes in which all participants used safety equipment resulted in some level of injury, and three percent resulted in fatal or incapacitating injury.

**Table 16: Safety Equipment Usage, Redmond, Crashes 2012-2016**

	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal & Injury A Total
Safety equipment used by all participants	4	30	195	426	698	1,353 (98%)	34 (92%)
Safety equipment not used by at least one participant	1	2	9	7	8	27 (2%)	3 (8%)
<b>Total</b>	<b>5</b>	<b>32</b>	<b>204</b>	<b>433</b>	<b>706</b>	<b>1,380</b>	<b>37</b>

## VULNERABLE ROAD USERS

### Pedestrians

As noted in the collision type discussion, pedestrian crashes constitute a relatively low share of overall crashes in Redmond, with 18 reported pedestrian collisions. Pedestrian crashes accounted for one percent of reported crashes in Redmond. However, when pedestrians are involved in crashes, the results are more likely to be severe than in crashes involving only vehicles. The 18 reported pedestrian crashes in Redmond all

resulted in some level of injury between 2012 and 2016. Two of these reported crashes resulted in fatality, and one crash resulted in an incapacitating injury. Pedestrian crashes accounted for eight percent of the total fatal/incapacitating crashes in Redmond.

Reported contributing factors indicated that *did not yield right-of-way* was reported in 12 of the pedestrian crashes, and seven of the pedestrian crashes also indicated that the *non-motorist clothing was not visible*. One-third (6 crashes) of crashes involving pedestrians occurred between the hours of 5:00 pm and 6:00 pm. Half of the pedestrian crashes occurred in dark, dawn, or dusk light conditions. Four of the pedestrian crashes involved alcohol or drugs.

## Bicyclists

Bicyclist crashes also constitute a relatively low share of total crashes but were more likely to result in injury when they occurred. Between 2012 and 2016, 16 bicycle crashes were reported in Redmond. Of these crashes, 14 (88 percent) resulted in injury of some level, including two (13 percent) incapacitating injury crashes.

The highest number of bicycle crashes occurred between 12:00 pm and 1:00 pm, when three bicycle crashes were reported. The majority (81 percent) of bicycle crashes occurred in daylight conditions.

## Motorcycles

Between 2012 and 2016, 31 reported crashes in Redmond involved motorcycles. As shown in Table 17, the 31 motorcycle crashes each resulted in some level of injury. Seven (23 percent) of the motorcycle crashes resulted in a fatal or incapacitating injury. In comparison, 48 percent of the non-motorcycle crashes resulted in some level of injury, and two percent of the non-motorcycle crashes resulted in a fatal or incapacitating injury. Overall, motorcycles were involved in 19 percent of fatal and incapacitating crashes in Redmond.

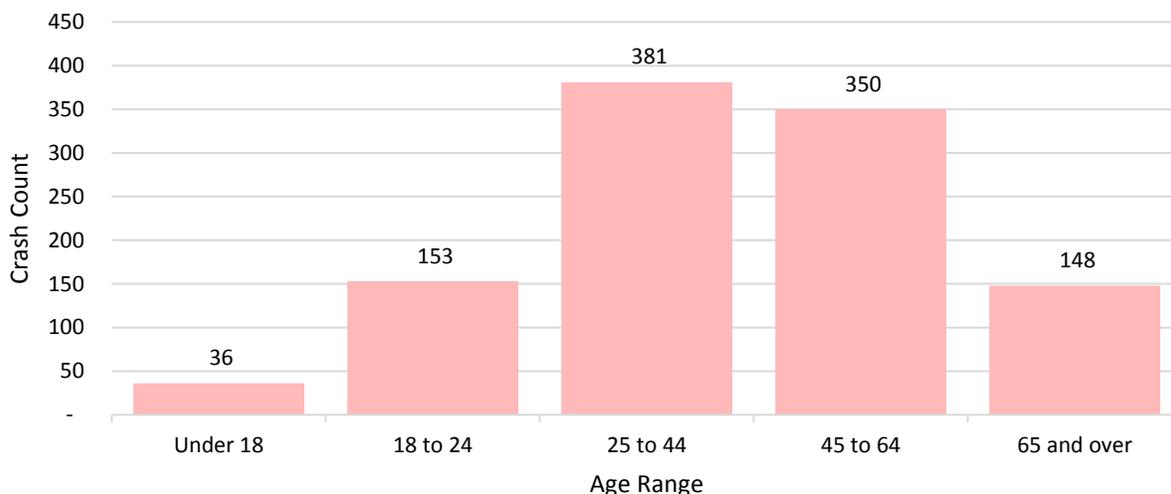
**Table 17: Crashes Involving Motorcycles, Redmond, Crashes 2012-2016**

	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal & Injury A Total
Motorcycle Involved	1	6	17	7	0	31 (2%)	7 (19%)
No Motorcycle Involved	4	26	187	426	706	1,349 (98%)	30 (81%)
<b>Total</b>	<b>5</b>	<b>32</b>	<b>204</b>	<b>433</b>	<b>706</b>	<b>1,380</b>	<b>37</b>

## Driver Age

Figure 61 summarizes the distribution of age for drivers involved in crashes in Redmond. Fourteen percent (148 crashes) of reported crashes, and eight percent (three crashes) of fatal/incapacitating crashes, involve drivers age 65 and older. Seventeen percent (189 crashes) of reported crashes, and 20 percent (seven crashes) of fatal/incapacitating crashes, involve drivers under age 25. Of the 148 crashes involving drivers over age 65, two percent resulted in fatal or incapacitating injury. Of the 189 crashes involving drivers under age 25, four percent resulted in fatal or incapacitating injury.

**Figure 61: Driver Age in Crashes, Redmond, 2012 – 2016**



Note: Driver age was available in crash records for 1,068 reported crashes, including 36 fatal/incapacitating crashes. This chart and summary statistics reflect only the crashes with driver age information.

## SUMMARY OF REDMOND CRASH ANALYSIS

Based on the crash data analysis, Kittelson identified the following potential emphasis areas for Redmond (bold text indicates emphasis areas that align with Oregon statewide emphasis areas):

### ► **Intersection related crashes**

- *Turning movement, angle, and rear-end* crashes accounted for 79 percent of reported crashes and 68 percent of fatal/incapacitating crashes.

### ► **Excessive speeds**

- Speed was involved in 27 percent of fatal/incapacitating crashes in Redmond.

### ► **Motorcycles**

- Motorcycles were involved in 19 percent of fatal/incapacitating crashes in Redmond.
- 100 percent of the 31 reported motorcycle crashes resulted in some level of injury.

### ► **Pedestrian crashes**

- The 18 reported pedestrian crashes in Redmond resulted in some level of injury.
- Three of these crashes resulted in fatal or incapacitating injury, accounting for eight percent of overall fatal/incapacitating crashes in the City.

### ► **Bicycle crashes**

- 88 percent of the 16 reported bicycle crashes in Redmond resulted in some level of injury.
- Two crashes resulted in incapacitating injuries.

### ► **Roadway departure crashes**

- Roadway departure crashes accounted for 17 percent of reported crashes in Redmond and 22 percent of fatal/incapacitating crashes.

### ► **Alcohol/drugs involved**

- Alcohol/drugs were involved in 11 percent of fatal/incapacitating crashes.

▶ **Safety equipment usage**

- 70 percent of crashes involving at least one participant not using safety equipment resulted in some level of injury.

▶ **Dark, dawn, or dusk conditions**

- 43 percent (16 crashes) of fatal/incapacitating crashes occurred in dark, dawn, or dusk conditions.

*These potential emphasis areas were identified based on crash data and will be discussed with the County Project Management Team and advisory committees to agree upon emphasis areas. Some emphasis areas may be prioritized over others based on fatal and incapacitating crashes.*

## CITY OF SISTERS

The City of Sisters is located in Deschutes County, approximately twenty miles west of Redmond. This section summarizes the reported crashes and crash characteristics within city limits.

According to the Portland State University (PSU) Population Estimates, the City of Sisters grew from approximately 2,040 residents in 2010 to 2,540 residents in 2017, as shown in Figure 62. This growth equates to a total of 24.5 percent growth between 2010 and 2017, or an average of 3.5 percent growth per year.

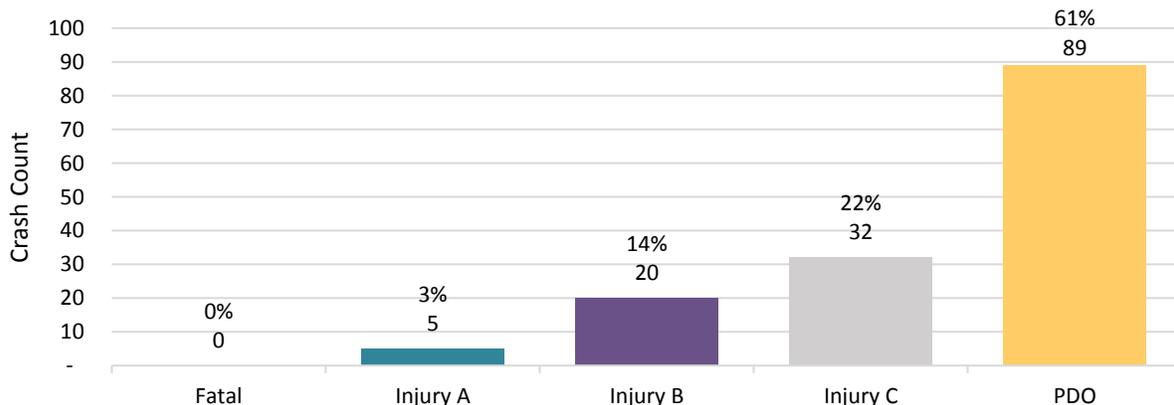
**Figure 62: City of Sisters Population Estimates by Year**

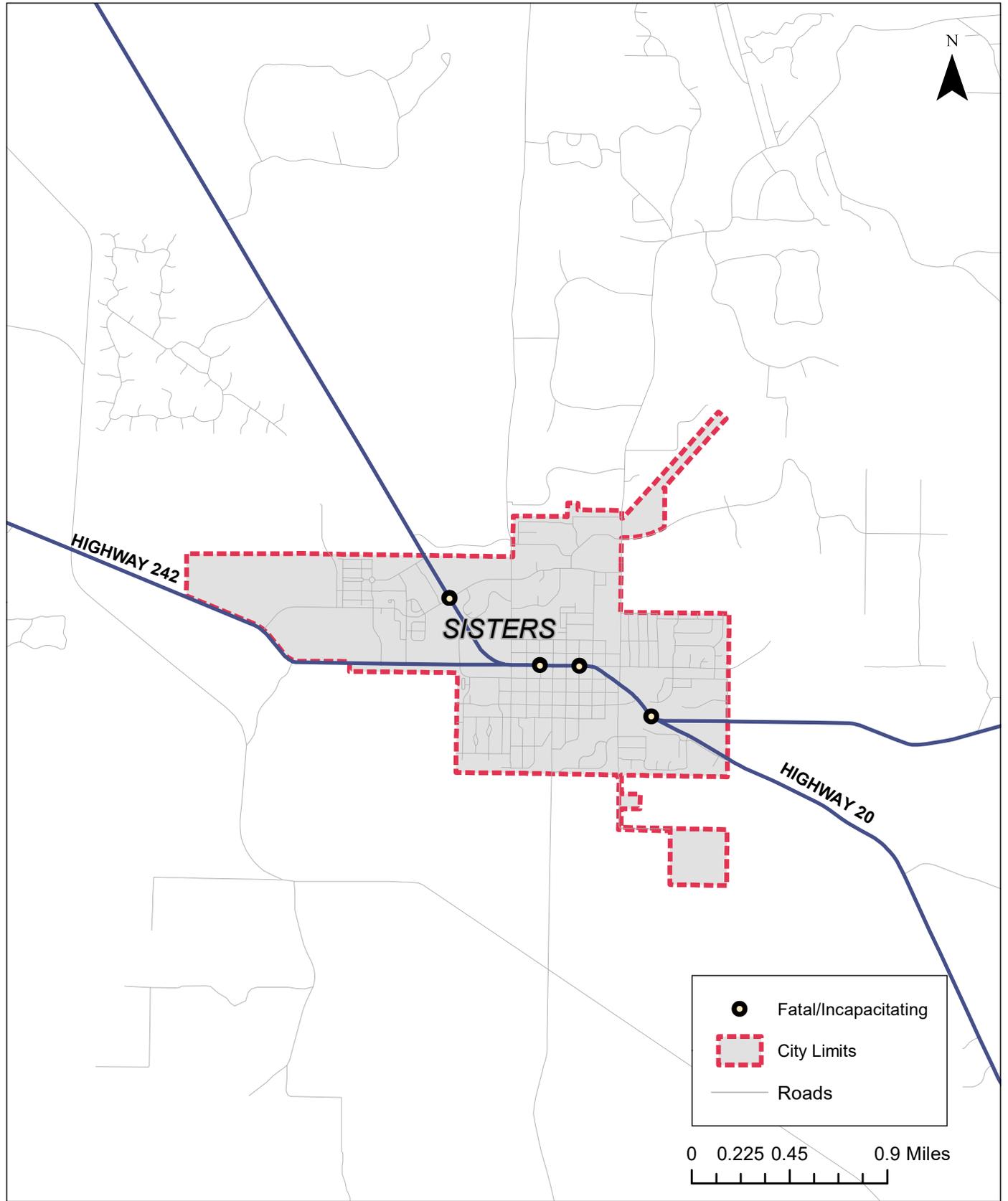


Source: PSU Population Estimates; Kittelson & Associates

Between 2012 and 2016, 146 crashes were reported in Sisters. Of these, 39 percent resulted in some level of injury, and three percent (five crashes) resulted in an incapacitating injury, as shown in Figure 63. Figure 64 illustrates the location of the incapacitating crashes within the City. As shown on the figure, the incapacitating crashes occurred on Highway 20 (a state highway). Overall, 69 percent of reported crashes occurred on the state highway.

**Figure 63: Reported Crashes by Severity, Sisters, 2012-2016**





**Fatal and Incapacitating Injury Crashes  
City of Sisters**

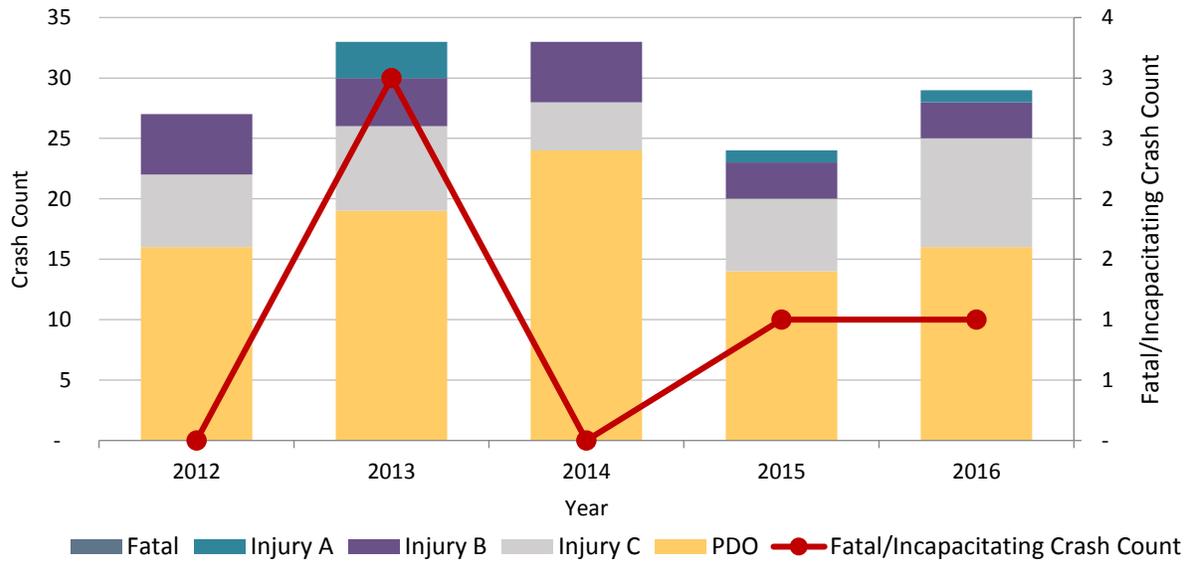
**Figure  
64**

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## CRASH SUMMARY BY YEAR, MONTH, DAY, AND TIME

The number of reported crashes per year has remained generally constant in Sisters from 2012 through 2016, as shown in Figure 65, ranging from 24 to 33 crashes per year. The percent of crashes that resulted in an injury ranged from 27 percent to 45 percent each year. As shown in the figure, the number of incapacitating crashes per year varied from zero to three, with the highest number reported in 2013.

Figure 65: Reported Crashes by Year, Sisters 2012-2016



The number of crashes per month is shown in Figure 66. The number of crashes each month varied from five to 21 crashes, with the highest crash frequency occurring in July and August. The number of incapacitating crashes each month varied from zero to two per month and did not show strong seasonal trends.

Figure 66: Reported Crashes by Month, Sisters, 2012-2016

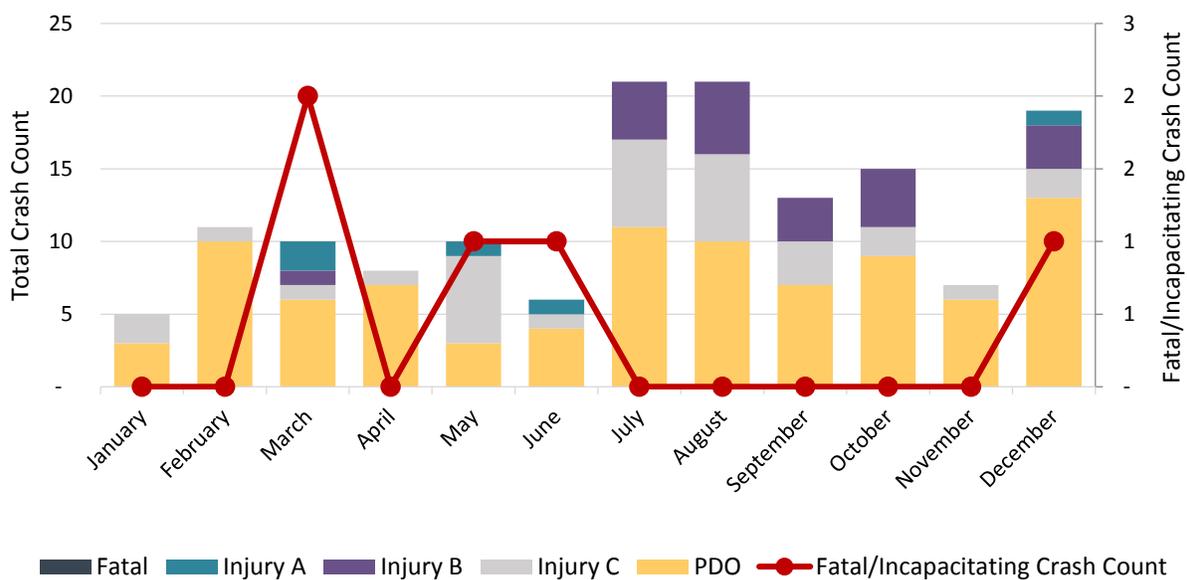


Figure 67 shows the reported crashes by day of the week. The total number of crashes per day varied from 13 to 24 crashes and did not show strong trends.

**Figure 67: Reported Crashes by Weekday, Sisters, 2012-2016**

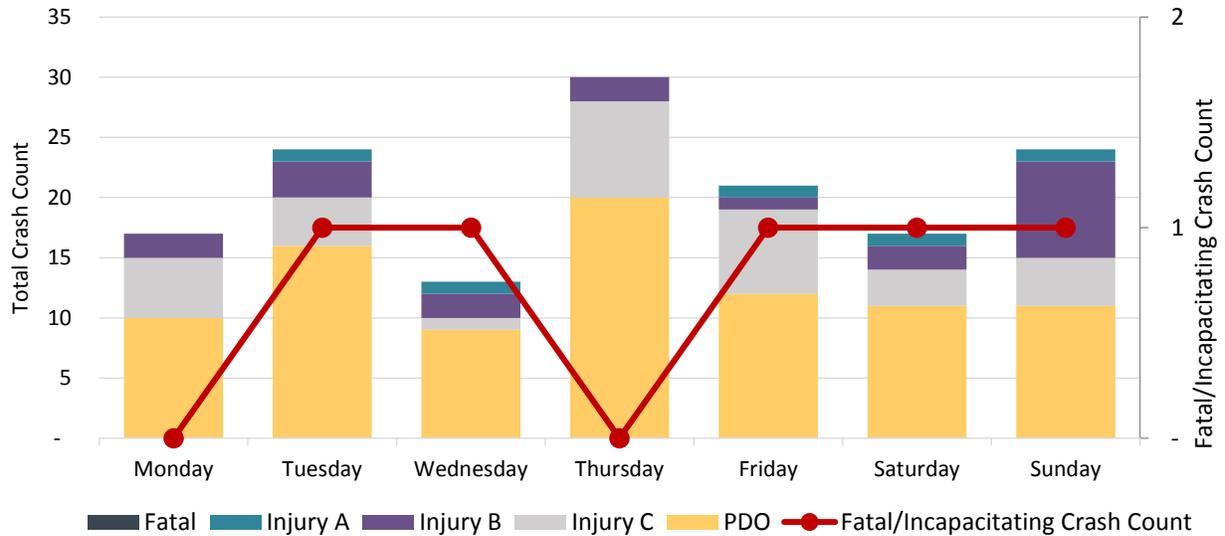
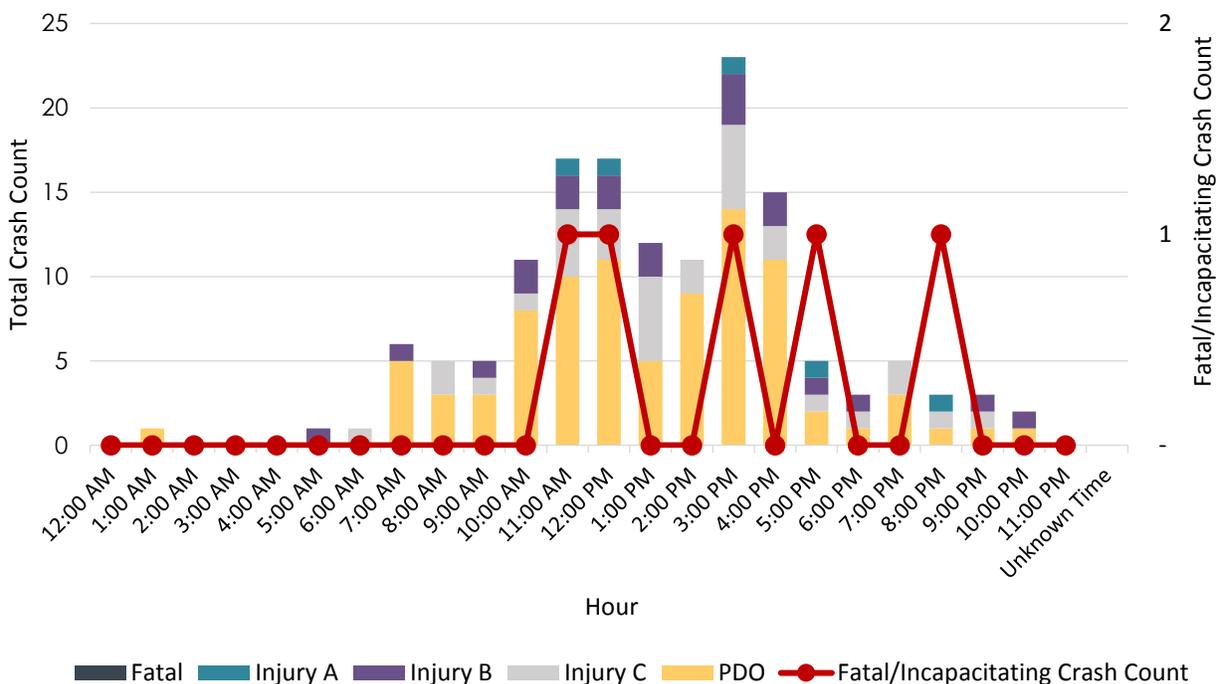


Figure 68 shows the highest number of crashes occurred during afternoon time period, between 3:00 pm and 4:00 pm. Sixteen percent of reported crashes occurred during this hour. The five incapacitating crashes were spread throughout the day, occurring between 11:00 am and 9:00 pm.

**Figure 68: Reported Crashes by Time of Day, Sisters, 2012 – 2016**



## ROADWAY CHARACTERISTICS

### Light Conditions

Reported light conditions for each crash describes the amount of ambient light available at the time of crash. Of the reported crashes, summarized in Table 18, 88 percent occurred in daylight conditions and two percent of those were incapacitating crashes. Approximately 12 percent of crashes occurred in dark, dawn, or dusk conditions. Approximately 40 percent (two crashes) of incapacitating crashes occurred in dark or dusk conditions.

Among the 17 crashes that occurred in dark, dawn, or dusk conditions, two crashes (five percent) resulted in incapacitating injuries, and 53 percent resulted in some level of injury. Among 129 the crashes that occurred in daylight, three crashes (two percent) resulted in incapacitating injuries, and 37 percent resulted in some level of injury.

**Table 18: Reported Crashes by Light Conditions and Severity, Sisters, 2012 – 2016**

Light Conditions	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal & Injury A Total
Daylight	-	3	17	28	81	129 88%	3 60%
Darkness – no street lights	-	-	3	3	3	9 6%	0 0%
Dusk (Twilight)	-	1	-	-	3	4 3%	1 20%
Darkness – with street lights	-	1	-	1	1	3 2%	1 20%
Dawn (Twilight)	-	-	-	-	1	1 1%	0 0%
<b>Total</b>	<b>-</b>	<b>5</b>	<b>20</b>	<b>32</b>	<b>89</b>	<b>146</b>	<b>5</b>

### Roadway Surface Conditions

Table 19 shows that the majority of reported crashes (84 percent) occurred on dry roadway surface conditions. The remaining crashes occurred on ice (eight percent), wet roads (three percent), snow (four percent), or unknown surface conditions (one percent). One incapacitating crash occurred on icy road conditions; the remaining four incapacitating crashes occurred on dry roadways.

Among the 122 crashes that occurred on dry roadways, 43 percent resulted in some level of injury. Among the 18 crashes that occurred on snow or ice, 11 percent resulted in some level of injury.

**Table 19: Reported Crashes by Roadway Conditions and Severity, Sisters, 2012 – 2016**

Road Conditions	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal & Injury A Total
Dry	-	4	18	30	70	122 84%	4 80%
Ice	-	1	1	-	10	12 8%	1 20%
Wet	-	-	1	2	2	5 3%	- 0%
Snow	-	-	-	-	6	6 4%	- 0%
Unknown	-	-	-	-	1	1 1%	- 0%
<b>Total</b>	<b>-</b>	<b>5</b>	<b>20</b>	<b>32</b>	<b>89</b>	<b>146</b>	<b>12</b>

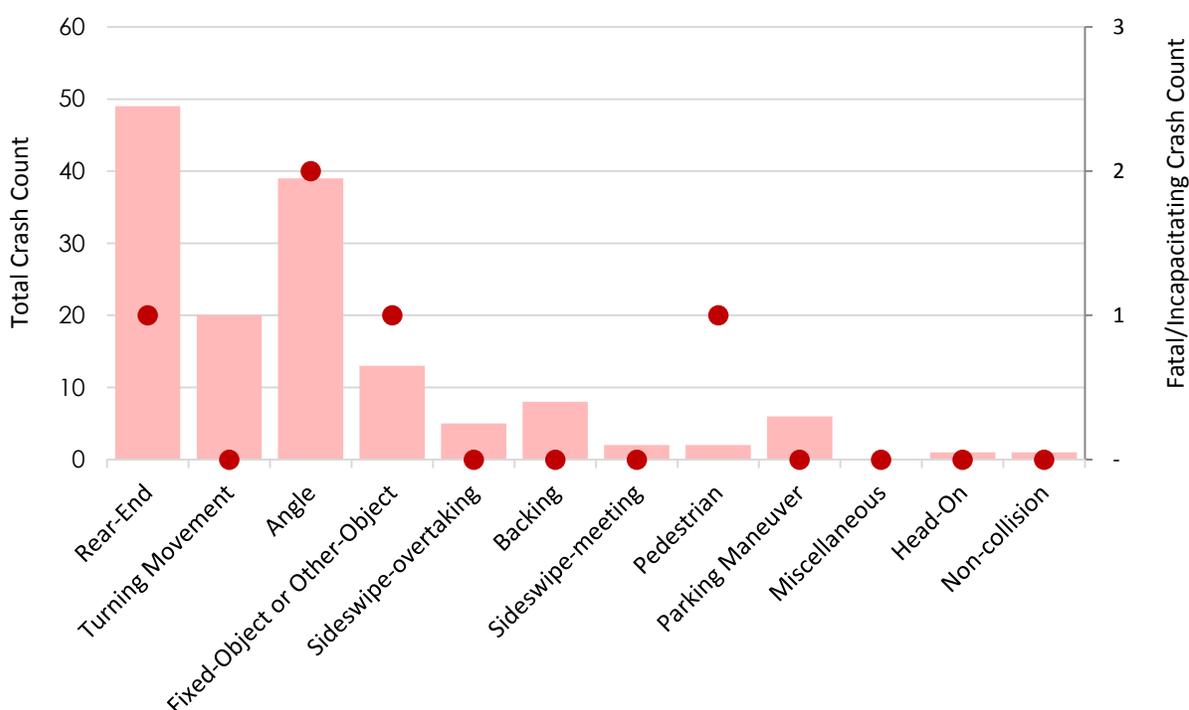
## CRASH TYPE AND CONTRIBUTING FACTORS

### Collision Type

The most common collision types among reported crashes in Sisters were *rear-end* crashes (34 percent), *angle* crashes (27 percent), and *turning movement* crashes (14 percent), as shown in Figure 69. The five incapacitating crashes included two *angle* crashes, one *rear-end* crash, one *fixed-object* crash, and one *pedestrian* crash.

The collision types most likely to result in some level of injury included *pedestrian* (both *pedestrian* crashes resulted in injury), *sideswipe-meeting* (both crashes resulted in injury), *rear-end* (47 percent of the 49 reported crashes resulted in injury), *angle* (38 percent of the 39 reported crashes resulted in injury), *fixed-object* (31 percent of the 13 reported crashes), and *turning movement* (30 percent of the 20 reported crashes).

Figure 69: Reported Crashes by Collision Type, Sisters, 2012 – 2016



The statewide Oregon TSAP identifies intersection crashes and roadway departure crashes as emphasis areas for the state.

*Turning movement*, *angle*, and some *rear-end* crashes are typically associated with intersections. These three crash types account for 74 percent of reported crashes in Sisters and 60 percent (three of the five crashes) of the incapacitating crashes in Sisters. Of the 108 reported *rear-end*, *turning movement*, and *angle* crashes in Sisters, 41 percent resulted in some level of injury, and three percent resulted in incapacitating injury.

Roadway departure crashes, or lane departure crashes, include those in which vehicles leave their travel lane: *fixed object or other object*, *head-on*, *sideswipe*, and *non-collision (rollover)*. These roadway departure crash types account for 15 percent of reported crashes in Sisters and 20 percent (one of five crashes) of incapacitating crashes. Of the 22 reported *fixed object*, *head-on*, *sideswipe*, and *non-collision (rollover)* crashes in Sisters, 36 percent resulted in some level of injury, and one crash (five percent) resulted in incapacitating injury.

## Contributing Factors

The most common reported contributing factors included *did not yield right-of-way* (40 percent), *followed too closely* (19 percent), *speed too fast for conditions (not exceeding limit)* (eight percent), and *inattention* (eight percent).

The contributing factors associated with the incapacitating crashes included *did not yield right-of-way* (three of the five crashes) and *inattention* (one crashes).

## BEHAVIORAL CHARACTERISTICS

### Alcohol/Drugs Involved

The influence of alcohol and drug use in reported crashes is coded in the crash data from the officer's assessment. In the case of drug use, a crash would be flagged if drug use is reported by the police, by test results, or if the suspect admits use. A flag in the data for alcohol use would occur from observations at the scene, breath or field sobriety tests, or conclusions in the reporting officer's narrative. The two flags are combined for summary here.

Three percent (four crashes) of reported crashes in Sisters involved alcohol or drugs. None of the incapacitating crashes reported alcohol or drugs as a factor. Of the four crashes that involved alcohol or drugs, three resulted in moderate injury (75 percent), and one did not result in injury.

### Speeding

Speeding is captured in two separate contributing factors as discussed above (exceeding the posted speed limit and traveling too fast for conditions). ODOT summarizes this data in an "excessive speeding" flag to identify crashes associated with speed as a factor. As shown in Table 20, excessive speeds were flagged in approximately 10 percent of all crashes. The five incapacitating crashes did not involve excessive speed. Of the 14 crashes that involved excessive speed, 14 percent resulted in a minor or moderate injury.

Table 20: Excessive Speeding Crashes, Sisters, 2012 – 2016

Excessive Speed Flag	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal & Injury A Total
No	0	5	19	31	77	132 (90%)	5 (100 %)
Yes	0	0	1	1	12	14 (10%)	0 (0 %)
<b>Total</b>	-	<b>5</b>	<b>20</b>	<b>32</b>	<b>89</b>	<b>146</b>	<b>5</b>

### Safety Equipment Use

Crash data indicates the number of participants in a crash who used and did not use safety equipment. Safety equipment includes a variety of items including seat belts, child seats, booster seats, and bike helmets. Based on this data, four crashes in Sisters involved at least one participant not using safety equipment. The four crashes each resulted in moderate injuries.

## VULNERABLE ROAD USERS

### Pedestrians

As noted in the collision type discussion, pedestrian crashes constitute a relatively low share of overall crashes in Sisters, with two reported pedestrian collisions. However, when pedestrians are involved in crashes, the results are more likely to be severe than in crashes involving only vehicles. Both pedestrian crashes resulted in injury. One crash resulted in an incapacitating injury, and one crash resulted in a minor injury.

Both crashes occurred in dark conditions and did not involve alcohol or drugs. One crash occurred between 5:00 pm and 6:00 pm, and the other crash occurred between 9:00 pm and 10:00 pm.

## Bicyclists

Bicyclist crashes also constitute a relatively low share of total crashes but are more likely to result in injury when they occur. Between 2012 and 2016, four bicycle crashes were reported in Sisters. Three crashes resulted in moderate injuries, and one crash resulted in minor injuries.

Three of the bicycle crashes occurred during daylight morning hours, between 7:00 am and 11:00 am, and one crash occurred in the dark between 10:00 pm and 11:00 pm. None of the four reported crashes involved alcohol or drugs.

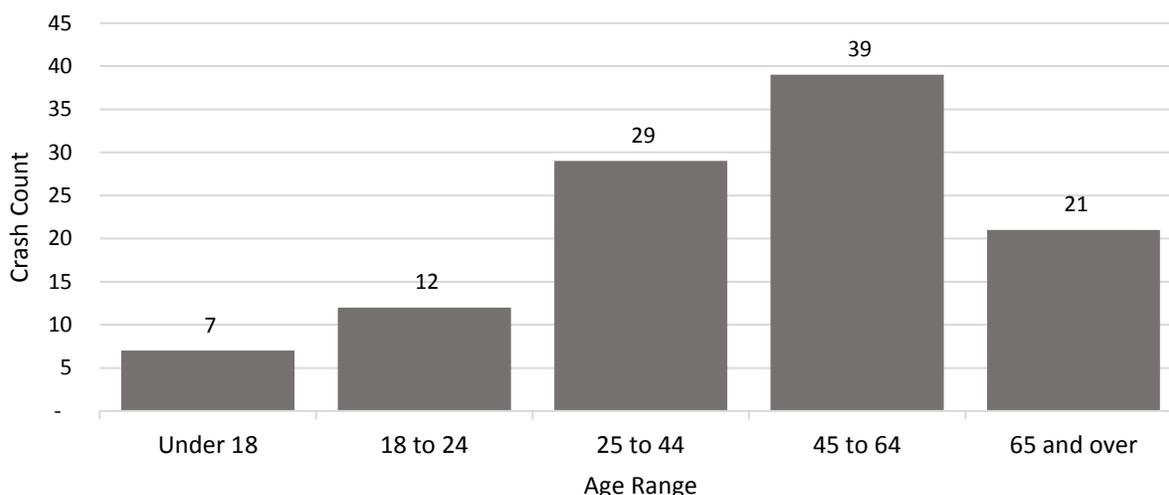
## Motorcycles

Between 2012 and 2016, four reported crashes in Sisters involved motorcycles. One crash resulted in an incapacitating injury; one crash resulted in a minor injury; and two crashes did not result in injury.

## Driver Age

Figure 70 summarizes the distribution of age for drivers involved in crashes in Sisters. Nineteen percent (21 crashes) of reported crashes, involved drivers age 65 and older. Seventeen percent (19 crashes) of reported crashes involved drivers under age 25. None of these crashes resulted in incapacitating injury.

Figure 70: Driver Age in Crashes, Sisters, 2012 – 2016



Note: Driver age was available in crash records for 108 reported crashes, including 3 fatal/incapacitating crashes. This chart and summary statistics reflect only the crashes with driver age information.

## SUMMARY OF SISTERS CRASH ANALYSIS

Based on the crash data analysis, Kittelson identified the following potential emphasis areas for Sisters (bold text indicates emphasis areas that align with Oregon statewide emphasis areas):

### ► Intersection related crashes

- *Turning movement, angle, and rear-end* crashes accounted for 74 percent of reported crashes and three of the five reported incapacitating crashes.

- 41 percent of *turning movement, angle, and rear-end* crashes resulted in some level of injury.
- ▶ Crashes on Highway 20
  - Incapacitating crashes occurred on Highway 20.
- ▶ Crashes in dark, dawn, or dusk light conditions
  - 53 percent of crashes in these light conditions resulted in injury, compared to daylight conditions which resulted in injury 37 percent of the time.
- ▶ **Alcohol/drugs involved**
  - Three percent of crashes (four crashes) involved alcohol/drugs.
  - Three of the four reported crashes involving alcohol/drugs resulted in an injury.
- ▶ **Safety equipment usage**
  - Four crashes were reported with at least one participant not using safety equipment; each of these four crashes resulted in injury.
- ▶ **Pedestrian crashes**
  - Both pedestrian crashes in Sisters resulted in injury, including one incapacitating injury.
- ▶ **Bicycle crashes**
  - The four reported bicycle crashes in Sisters resulted in injuries.
- ▶ **Older drivers**
  - 19 percent (21 crashes) of reported crashes involved drivers age 65 or over.

*These potential emphasis areas were identified based on crash data and will be discussed with the County Project Management Team and advisory committees to agree upon emphasis areas. Some emphasis areas may be prioritized over others based on fatal and incapacitating crashes.*

## 04 | OREGON TSAP EMPHASIS AREAS

Table 21 summarizes how the County and cities are performing in several Oregon TSAP emphasis areas, compared to the statewide performance in these areas. The table summarizes the share of fatal/incapacitating crashes involve various crash attributes.

As shown in the table, unincorporated Deschutes County performs similar to statewide data in the areas of alcohol/drug involved crashes. The County's fatal/incapacitating crashes reveal higher shares of crashes associated with roadway departure crashes, speed-related crashes, and unrestrained occupants, compared to the state average. The County performs better than statewide comparisons in the areas of intersection crashes, young and older drivers, and pedestrians and bicyclists. These comparisons are based solely on fatal/incapacitating crashes.

**Table 21: Percent of Fatal/Incapacitating Crashes by Attributes**

	Statewide*	Deschutes County (Unincorporated)	La Pine	Redmond	Sisters
Roadway or Lane Departure Crashes	53.5%	71%**	16%**	22%**	20%**
Intersection Crashes	34.4%	23%**	58%**	68%**	60%**
Speed-Related Crashes	27.0%	42%	8%	27%	0%
Alcohol and/or Other Drugs Involved	22.1%	24%	25%	11%	0%
Young Drivers (<25) Involved	30.9%	9%	0%	20%	0%
Unrestrained Occupants	13.4%	19%***	8%***	8%***	0%***
Older Drivers (65 or older) Involved	20.2%	13%	50%	8%	0%
Pedestrian(s) Injured or Killed	10.0%	1%	33%	8%	20%
Bicyclist(s) Injured or Killed	4.4%	3%	0%	5%	0%

\*Obtained from Oregon TSAP

\*\*Based on intersection crash types.

\*\*\*Reflects crashes that involve at least one participant not using safety equipment, which includes restraints as well as bicycle helmets.

## 05 | NEXT STEPS

Upon incorporating input from Deschutes County, the Oregon Department of Transportation, and the cities of Redmond, Sisters, and La Pine, this memorandum will be finalized with priority emphasis areas identified. The next steps of the project will involve network screening, developing systemic recommendations, and identifying sites for development engineering solutions.

## ATTACHMENT A: FRAMEWORK MEMORANDUM